American Machinist

AUGUST 29, 1946

In this issue LIGHTING FOR PRODUCTION

You're Looking into the "COCKPIT" of a HEALD BORE-MATIC

. . . where special tool indicators assure finer production . . . faster . . . at lower cost

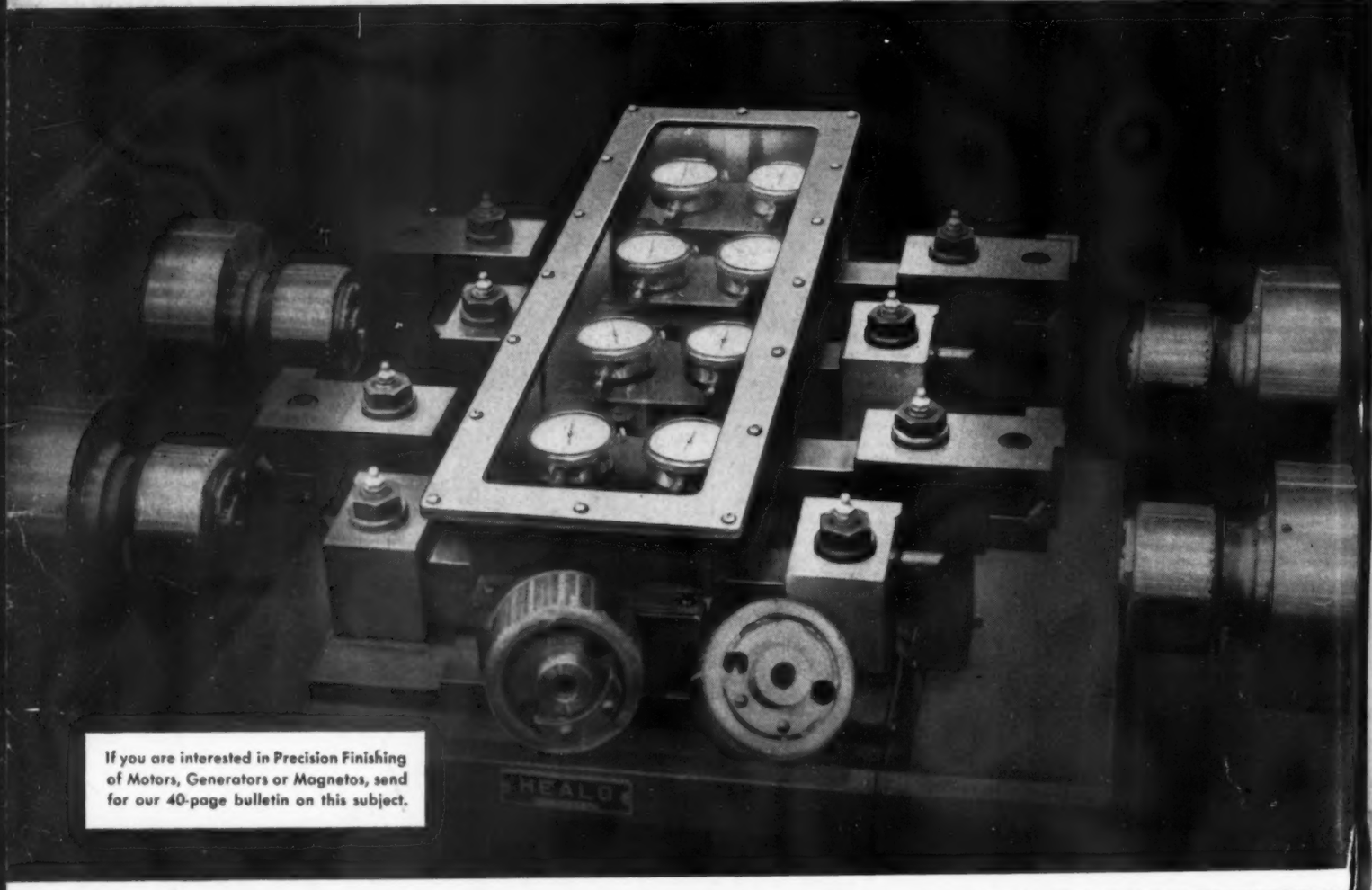
Just as an airplane instrument panel reveals the smallest variance in flight, so this special arrangement of sensitive tool indicators on a Heald Double-End Bore-Matic accurately checks the tools for machining of refrigerator rotors to precision tolerances. Each of the four stations is provided with two dial indicators, one measuring the setting of the turning tool, and one the boring and chamfering tools. These indicators immediately point out machining errors—allow tool adjustments to be made quickly, accurately, easily. Result? Big savings in down time that mean a higher volume of output, and a lower percentage of costly rejects.

In another case, a manufacturer of electric motor parts found his rotor wheels loading with soft aluminum during grinding. He consulted Heald engineers, who showed him how to precision turn the rotors two at a time on a Heald Bore-Matic. Production rose from 70 parts an hour to 200!

Whatever your precision finishing problem, the chances are that experienced Heald engineers have the answer, and can design the right equipment to give you greater production at lower unit costs. For further information, write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision . . . less cost



If you are interested in Precision Finishing of Motors, Generators or Magnetos, send for our 40-page bulletin on this subject.

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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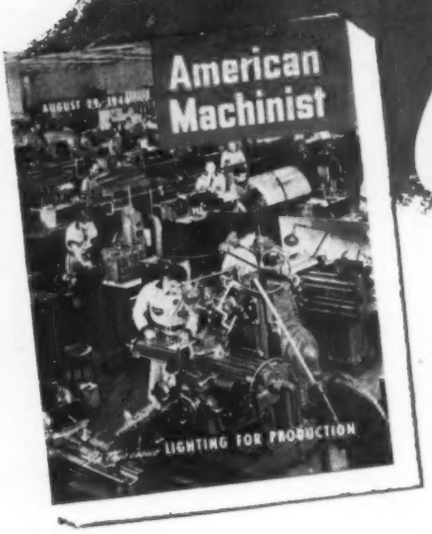


Chips and QUIPS

Mechanical Utopia . . . As an example of a well-lighted shop to introduce our special report on lighting in this issue, our cover Kodachrome shows a portion of the plant of the Woodward Governor Company, Rockford, Ill. Flush fluorescent fixtures in the soundproofed ceiling are supplemented by lights on machines. Power and service lines are brought up through the terrazo floor. The windowless plant is completely air-conditioned, and music is provided at intervals.

The lighting report, incidentally, was a terrific job of compaction, checked and approved by experts of the Illuminating Engineering Society, Nela Park and Westinghouse, among others.

Diesel Doctors . . . To combine maintenance data, railroad practice and the diesel, we present a report on methods of the Erie Railroad at its Ohio diesel service station. It's largely in pictures, for speedy reading . . . To follow up our June 20 description of electrostatic spray painting, Dr. Miller describes electrostatic detearing of dipped and flow-coated products, including (as did the earlier article) data not previously published.

Flash . . . C. B. Smith of Douglas shows typical flash-welding jobs as a preliminary to his description (Sept. 12) of tooling for flash-welding this variety . . . Caterpillar has a cost- and material-saving method of keying working elements of press dies to shoes. Walter Kamp describes it . . . Also a Navy method of checking sharpening of large drills, more on statistical quality control and on electronics, reference data on how to bond sapphire wear parts to metal or other materials.

Old Volumes . . . G. Edward Porter, 135 N. E. 50 Terrace, Miami, Fla., has two leather-bound volumes of *American Machinist*, Vol. 24 for 1901, and Vol. 25 for 1902. If you are interested, make him an offer.

On the Record . . . We're busting out in a rash of quotations, and in the durndest places! Two thousand reprints of Rupert LeGrand's special report on "Non-destructive Testing" (May 23 *A.M.*) are being bound in a current issue of *Industrial Radiography* magazine of the American Industrial Radium and X-Ray Society . . . From that same issue, *The American Horologist and Jeweler* is reprinting Associate Editor Harry Wharen's article, "Precision in Miniature—all about drilling and tapping small holes . . . And the Army Ordnance *Journal* is reprinting Managing Editor E. J. Tangerman's "Now the V-2 Flies for US" from *A.M.* for June 6.

Free Literature . . . It may not be amiss at this point to remind you of the insert which appears in the back of each issue of American Machinist offering new catalogs, booklets and bulletins. Editors scan incoming literature from manufacturers serving Metalworking . . . digest and list the new items in which they think you'd be interested. A convenient postcard makes requesting easy for you. This is a free service from which thousands of readers are benefiting.

Coming . . . Sept. 12 we bring you a special report on profit sharing and pensions by Chief Editor Finney, something new and startling on corrosion resulting from soldering copper wires, a roundup on carbide wear surfaces for dies, real background on coordination of new product development and a description of the new Wharton jig and fixture system developed in England . . . Also Dr. Gosta Truedsson begins a discussion of machine-tool design.

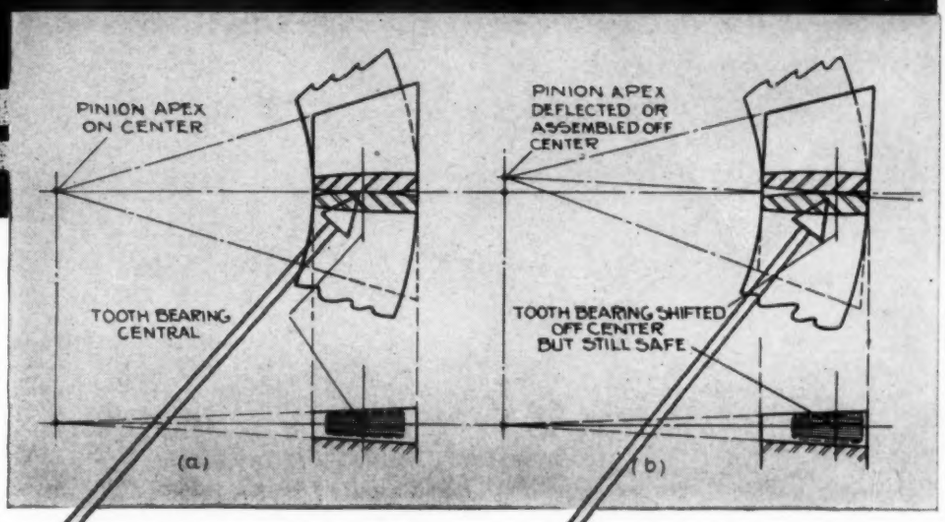
PAINT and LIGHT . . . Associate Editor Harry J. Williams, author of the 16-page special report on "Lighting for Production" in this issue, joined the *American Machinist* staff two years ago after serving for a similar period on the editorial staff of *Product Engineering*.

Before coming to McGraw-Hill, he was a newspaperman, associated with Westchester Publishers, Inc., for 13 years. During that time, he wrote on special assignment for *The Associated Press* and business sections of Metropolitan newspapers, and wrote articles for various trade publications. His writing experience stands him in good stead now in making sound shop practice more understandable in print.

Mr. Williams, who graduated from Wyoming Seminary and attended the University of Pennsylvania, also authored the special report on "How to Use COLOR in the Shop" which appeared May 9.

CONIFLEX

THE BEVEL GEAR WITH LOCALIZED TOOTH BEARING


PINION APEX ON CENTER
TOOTH BEARING CENTRAL
(a)
PINION APEX DEFLECTED OR ASSEMBLED OFF CENTER
TOOTH BEARING SHIFTED OFF CENTER BUT STILL SAFE
(b)

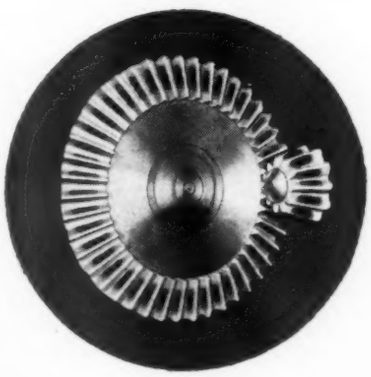
The usual operating position for generated straight bevel gears is here.

Coniflex gears can have the bearing changed here.

— and this can be done without dangerous concentration of load at the ends of the gear teeth.

The latest Gleason Straight Bevel Generators, in the medium and large sizes, have a positive cam-controlled advance of the tool slides at each end of the cutting stroke . . . result: a gear tooth relieved at the ends for:

1. **WIDER OPERATING TOLERANCES**
2. **SMOOTHER QUIETER OPERATION**
3. **EASIER ASSEMBLING**



For informative literature on Coniflex gears write for "Generated Straight Bevel Gears."

GLEASON Works
1000 University Avenue
Rochester 3, N. Y., U. S. A.

5 REASONS WHY

the New Cincinnati No. 2 MI

takes a real cut

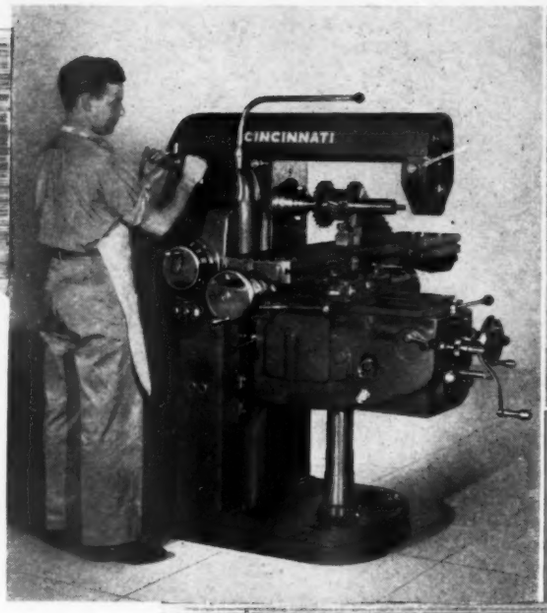
● Cutting the costs of machining operations goes hand in hand with cutting metal rapidly. That's why the new CINCINNATI No. 2 MI Milling Machines should be considered first for your new equipment program, for they take a real cut. Five reasons for the MI's unusual cutting capacity are shown here. And in addition to these rugged construction features, the machine offers an unusually wide range of speeds (25 to 1500 r.p.m.) and feeds (¼" to 30" per minute). The MI's are safe and easy to operate, and maintain new machine accuracy for years. ¶ We believe you will be interested in more details of the new No. 2 MI, driven by a 5 h.p. motor, available in Plain, Universal and Vertical styles. Catalog M-1429-1 contains engineering information. Write for your copy today.

1 This rear view of a Plain machine gives a good idea of its massiveness. Notice smooth lines and sturdy construction of the column.

CINCINNATI

THE CINCINNATI

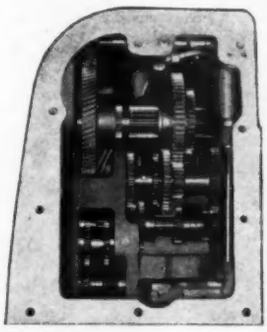
MILLING MACHINES



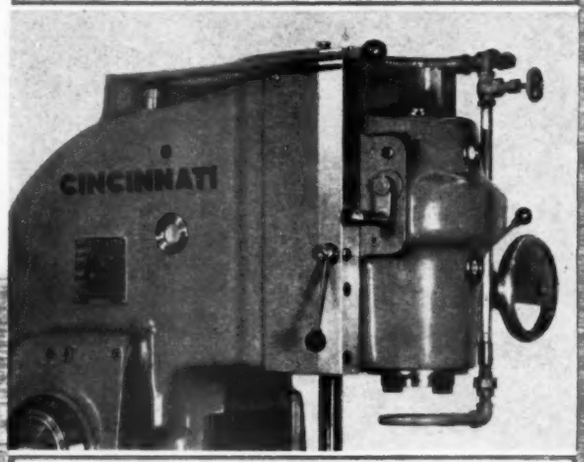
4 The sturdy rectangular overarm of the new No. 2 MI has a built-in vibration damper. Heavy construction and vibration damper in this unit eliminate the need for extra arbor support on most operations. Left, operator shows how easy it is to adjust the overarm.

2 Spindle drive gears.

Spindle drive gears of the new No. 2 MI's are mounted on short multiple spline shafts which run on anti-friction bearings.



5 Large, heavy knee unit with apron extension maintains accuracy of cross and vertical alignments. Notice the wide hand-scraped column and knee bearing.



3 On vertical style machine the head is unusually rugged. It is never outside its bearing ways in the column.

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

NO. 5 THE PUZZLE OF THE

VANISHING DOLLAR?

Get this! Three gents put up at a hotel, paying $30 rent in advance. Shortly afterward the clerk discovers that he has overcharged them $5, so he sends that amount back by the bellhop. But the bellhop, a weak character, returns only $3. Now the men have paid $27 and the bellhop has $2 — making a total of $29. *What became of the extra dollar?*

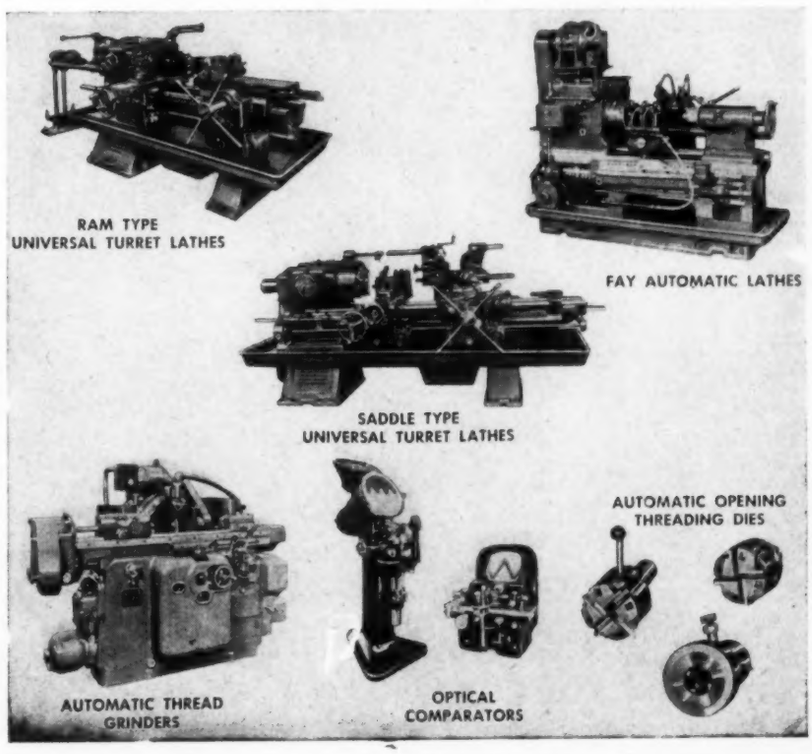
And a very appropriate little problem, too. For many's the dollar that's vanishing, these days, in seemingly simple operations.

Metal turning costs are a problem. The chances are that turning accounts for 25 per cent or more of all machining time in your plant.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the use of Jones & Lamson machines. Our machines are designed specifically for the most efficient use of carbide tools which can remove metal 200 to 500 per cent faster. We have solved many tough cost problems. Solving them is our business.

Be skeptical of the production efficiency of all metal turning equipment in your plant.

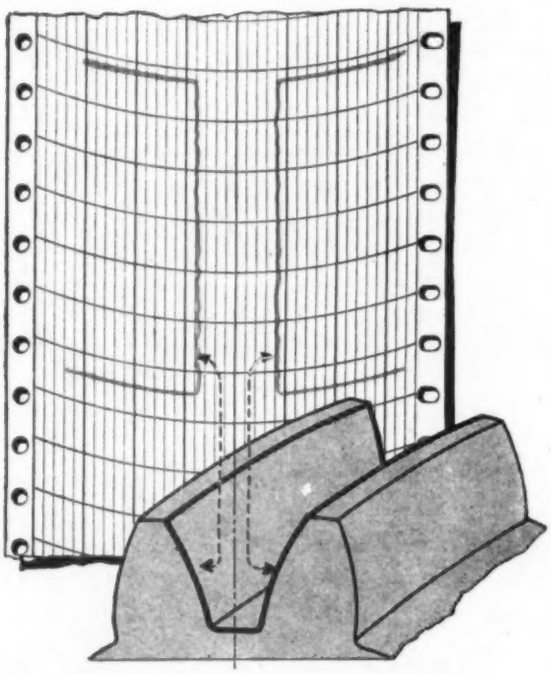
Telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.



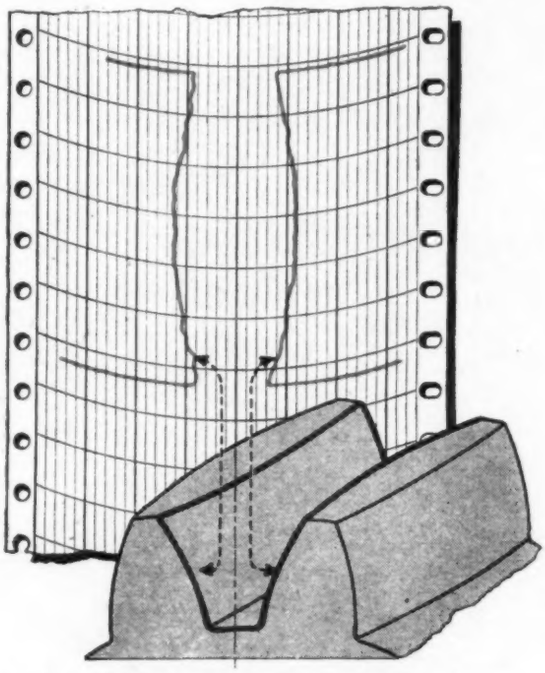
JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.

Inspecting "LEAD"*...CROWN..



With instrument set to check adjacent faces of helical gear teeth, if gear teeth are accurate, charted records will be straight lines.



In checking crown of spur gear teeth, the instrument is set for "zero lead", and amount of crowning in face width is indicated with reference to straight lines. (Here exaggerated for schematic illustration.)

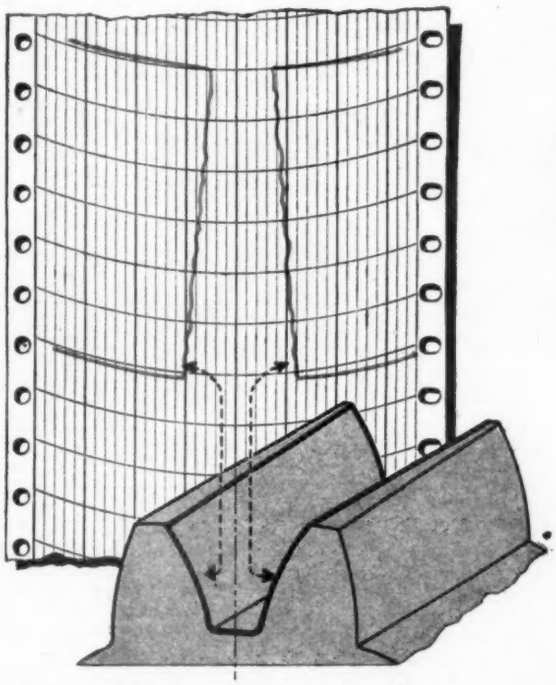
Here graphically presented are three typical charts of gear teeth which clearly depict the versatility of the No. 12H Fellows Lead Measuring Instrument. These charts, however, do not illustrate, or demonstrate, the simplicity and ease of operation of this outstanding Inspection Instrument. Settings can be accurately and quickly made by size blocks, and the functioning of the instrument can be easily and definitely checked. Readings are direct and positive and completely informative, and without any need for calculations. This new Inspection Instrument is fully explained and illustrated in a circular awaiting your request. Write: The Fellows Gear Shaper Company, Springfield, Vermont —or 616 Fisher Bldg., Detroit—or 640 West Town Office Bldg., Chicago.

GOVERNMENT SURPLUS MACHINE TOOLS...We are licensed under the WAR ASSETS ADMINISTRATION to act as dealers in the disposal of Government Surplus Machinery. Those interested in obtaining such machinery should contact our Main Office, Springfield, Vt.; or our offices in Detroit, Mich. and Chicago, Ill.

THE FELLOWS METHOD...MACHINES AND TOOLS FOR

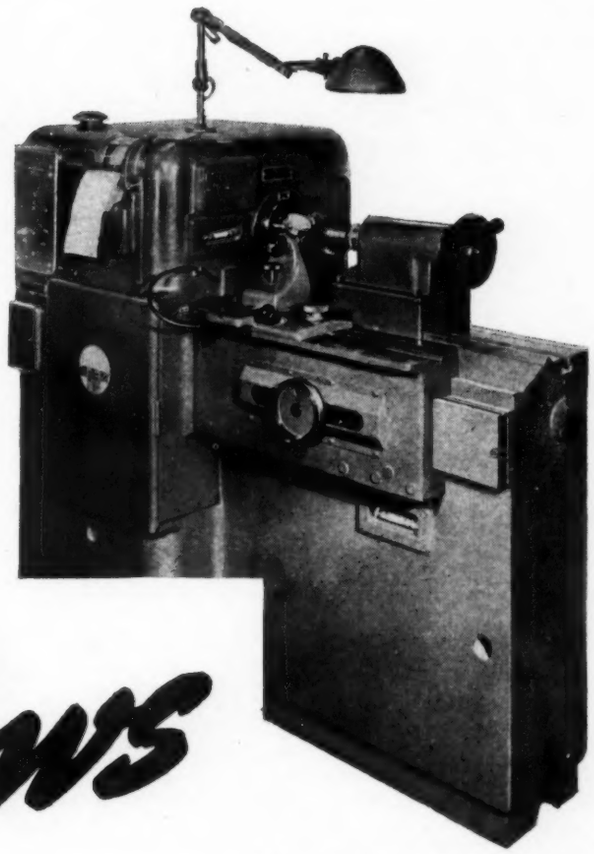
..TAPER of Helical or Spur Gear Teeth

with the NEW FELLOWS LEAD MEASURING INSTRUMENT



Similarly, for checking taper of spur gear teeth, instrument is set for "zero lead", and amount of taper in face width determined by deviation of charted lines from straight lines.

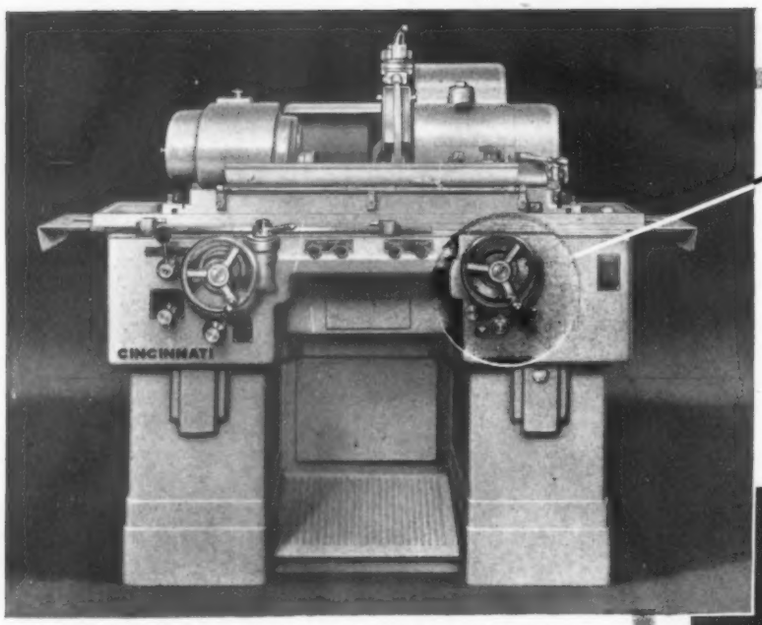
*As lead is the term used to define the distance travelled by a helix in a complete revolution of a cylinder, it is evident that the instrument indicates, on a magnified scale, the displacement of the tooth face in the face width of the gear tooth with reference to the desired helix for which the instrument is set.



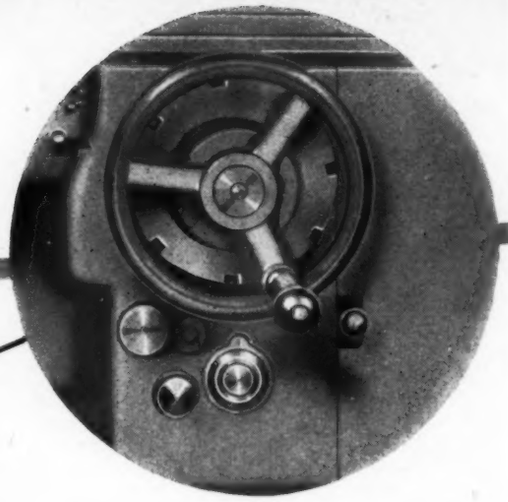
Fellows No. 12H Lead Measuring Instrument with Electrical Recorder for charting permanent Inspection records.

Fellows

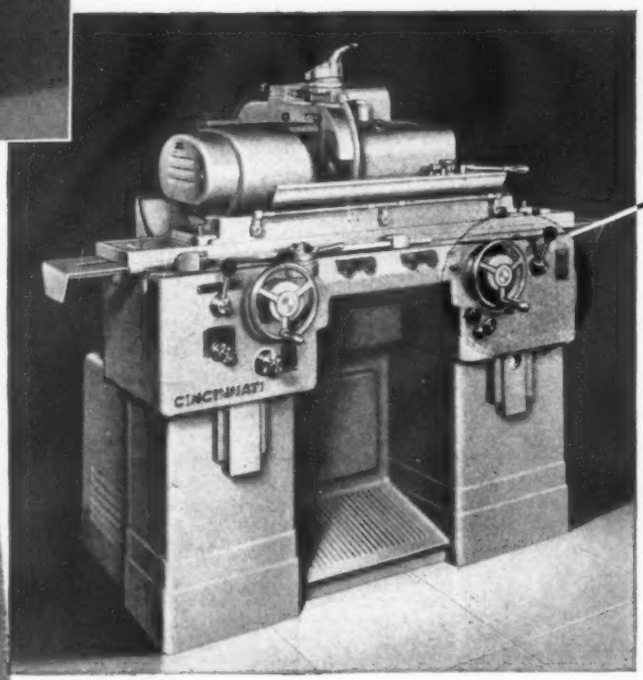
ALL OPERATIONS FROM BLANK TO FINISHED GEAR



The standard machine, built primarily for *traverse work*, has hand and power control of table movement, and conventional hand operation of the wheelhead cross slide for setting up the machine.



TRAVERSE OPERATIONS



In addition to all basic elements of the standard machine, this style includes a hydraulically actuated rapid advance and return of the wheelhead unit controlled by the cross feed hand wheel. Wheelhead has 3/8" to 1" adjustable stroke, a safety factor in loading and unloading, and gaging the work.

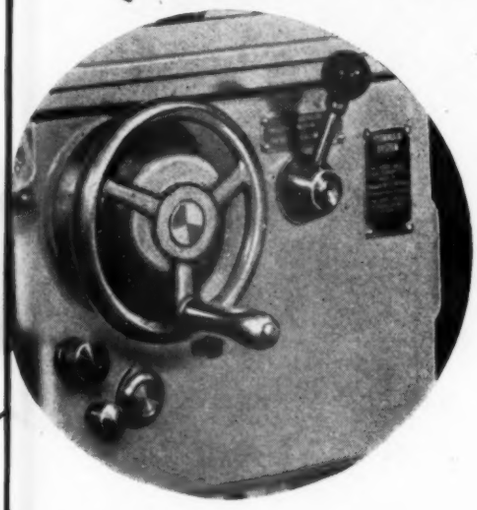
● Your small precision ground work, within the range of a 4" machine, may require traverse cycles only, it may be divided between traverse and infeed cycles, or it may be mostly infeed cycles. Whatever your requirements, one of the new CINCINNATI FILMATIC 4" Plain Hydraulic Grinders will fit your kind of work. ¶ This machine is built in three styles: 1) for traverse operations; 2) for traverse and hand infeed operations; 3) for traverse and automatic infeed operations. In the latter style, a *single lever* controls the infeed cycle. Many other features give these 4" machines high productive capacity for either small or large quantities of traverse and infeed work. ¶ They are built in 4" x 12" and 4" x 18" sizes. Complete engineering specifications may be obtained by writing for catalog G-520. Sweet's Catalog File for Mechanical Industries contains a brief description of these machines.

CINCINNATI

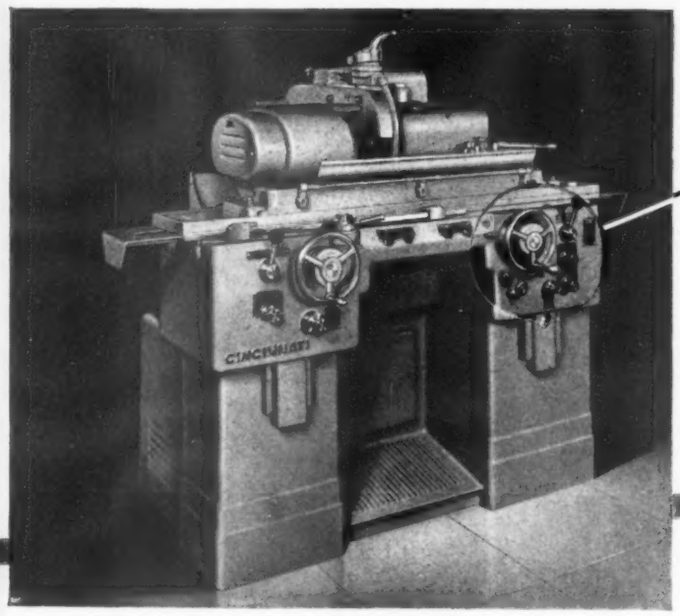
CENTER TYPE GRINDING MACHINES

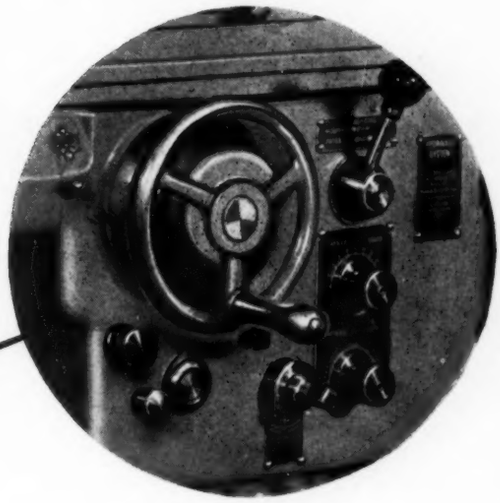
There's a style to fit your kind of work...

THE NEW CINCINNATI FILMATIC 4" PLAIN HYDRAULIC GRINDERS ARE AVAILABLE IN 3 STYLES



TRAVERSE AND HAND INFEED OPERATIONS





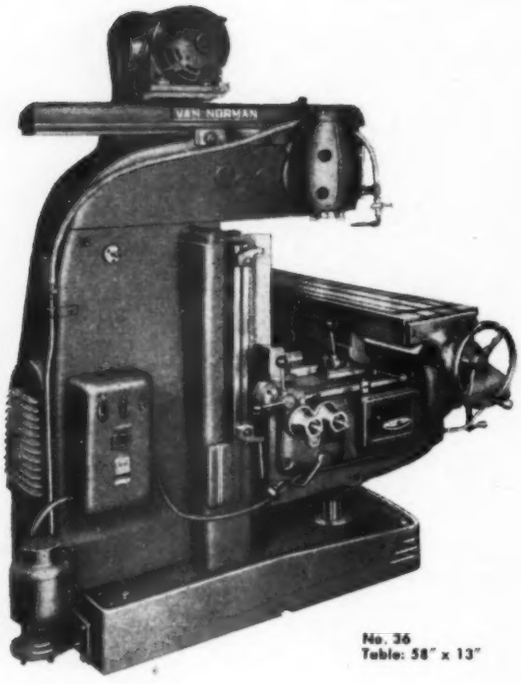
AUTOMATIC INFEED AND TRAVERSE OPERATIONS

This machine includes a full automatic infeed cycle to the wheelhead. The automatic cycle, initiated by a single lever, consists of rapid advance of wheelhead to grinding position, feed to depth of cut, tarry to spark-out, rapid retract wheelhead and stop cycle. Wheelhead has 3/8" to 1" adjustable stroke to facilitate loading.

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

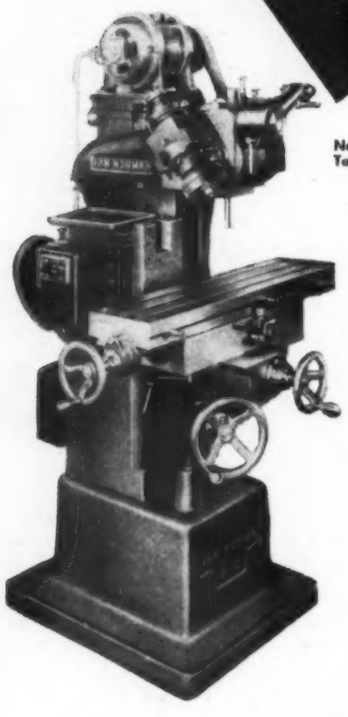
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES



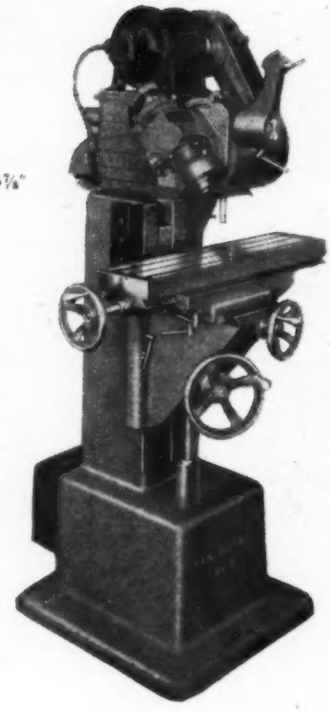
No. 36
Table: 58" x 13"

No. 22L
Table: 45" x 10"

Only Van Norman Ram Type



No. 12
Table: 37½" x 9³/₁₆"



No. 6
Table: 30" x 6⅞"

Milling Machines give you

★ HORIZONTAL

★ VERTICAL

★ AND ANGULAR

MILLING

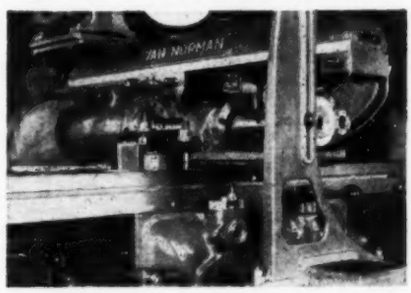
The big advantage of Van Norman Ram-Type Millers is their versatility. With these machines you can perform any kind of milling from horizontal to vertical simply by positioning the adjustable cutterhead. The result is increased machine production through elimination of idle operator and machine time. In addition, the adjustable cutterhead permits the operator to carry most jobs through to completion without changing the work setup . . . insuring accuracy and reducing rejects.

Here's a typical example of how Van Norman Ram-Type Millers fit into your general purpose and tool room picture. You have three ram-type millers. — Today the work schedule calls for two horizontal millers, one vertical. The operators simply position the cutterheads of two machines to horizontal and one to vertical and go ahead with the work. No waiting for specific machines . . . no loss in profits. Horizontal, vertical or angular, period to period, each Van Norman Ram-Type Miller can do the work.

Added to versatility, Van Norman gives you front and rear controls, exclusive single lever feed selector, movable ram, dovetail ram ways, plus other advantages which speed milling operations, save money and assure accurate work.

Investigate Van Norman Ram-Type Millers. They are available with plain or swiveling tables for every type of work. *Each machine will not only meet today's requirements but will be ready for tomorrow's jobs as well.*

The Ram-Type Miller used with the adjustable cutterhead in the vertical milling position and the operator using the front directional controls.



The Van Norman Ram-Type Miller with the head locked in the horizontal position for boring and facing.

With the cutterhead locked in an angular position, the operator is taking an angular cut on the workpiece, operating the Miller with the rear directional controls.

VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS

"It pays to Van Normanize"

. . . LANDIS

The Landis Automatic Forming and Threading Machine gives you maximum operating efficiency at low threading cost, since one operator and a helper easily service a battery of six or eight machines.

Results obtained in threading cap screws illustrate the production which may be expected with the Landis Automatic Forming and Threading Machine—threading 7/16 dia. 20 pitch N.F. cap screws made from alloy steel, more than 1000 screws are pointed and threaded per hour with one machine. Threads are held to Class 3 specifications.

For more production, finer accuracy and lower threading cost, use the Landis Automatic Forming and Threading Machine.

Bulletin E-70 will be sent upon request

More Production

Finer Accuracy

WITH THE LANDIS
AUTOMATIC FORMING
AND THREADING MACHINE

MACHINE CO. WAYNESBORO PENNA. U.S.A.

IT PAYS

to get the BEST...

It has been proven conclusively that it pays to get the best equipment available for the work to be done.

One widely known company recently installed an "American" Traversing Radial and promptly showed over a 40% reduction in drilling time.

Such savings are not exceptional. In fact they are the rule whenever the proper care is exercised in the selection of equipment. The hit and miss methods of machine tool buying that have existed in the past definitely will have to be discarded if the low cost demands of the future are to be met. From now on machine tool equipment must be selected on a production cost basis for only those plants that produce efficiently will survive the competitive era ahead.

"American" Lathes and Radial Drills have proven themselves to be low cost producers. They are modern; they are powerful; they have the stamina to insure unfaltering operation.

• *Send for descriptive literature*

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

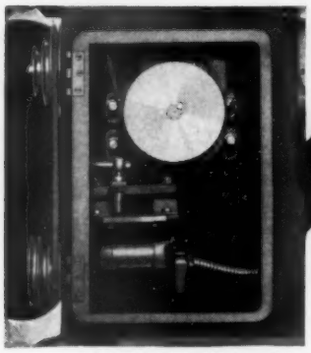
Lathes and Radial Drills

FOR IMMEDIATE DELIVERIES

Now

COVEL NO. 22

A UNIVERSAL CUTTER AND TOOL GRINDER *equipped with All-Electric Power Table Traverse and Wet Grinding Attachments*



ALL-ELECTRIC POWER TABLE TRAVERSE . . . Power from individual reversing motor drives through 3-step cone pulleys (V-belt) to gear case and through 2-step pulleys from gear case to table mechanism. Six various speeds available. All-electric system assures smooth, rapid table traverse. No clutches to wear out.

COMPLETE WET GRINDING ATTACHMENTS . . . Splash guards, pump, piping and tank for coolant are available to completely equip the 22 for wet grinding. Tank mounted on casters for easy handling and cleaning.

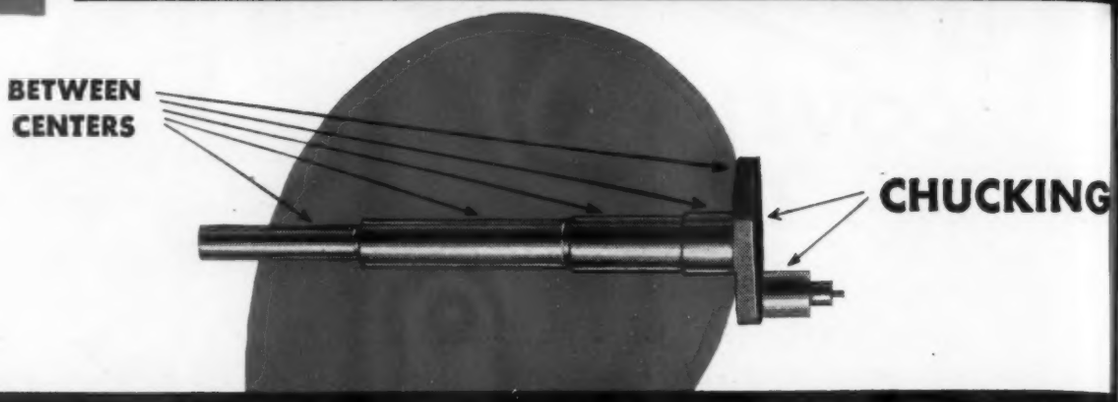
COVEL MANUFACTURING CO.
BENTON HARBOR, MICHIGAN

THE term *Universal* acquires a new significance when applied to the Covel No. 22 Universal Cutter and Tool Grinder. It's rugged, accurate and dependable. It's easy to set up, simple in operation and readily adaptable for fast grinding on a wide variety of jobs.

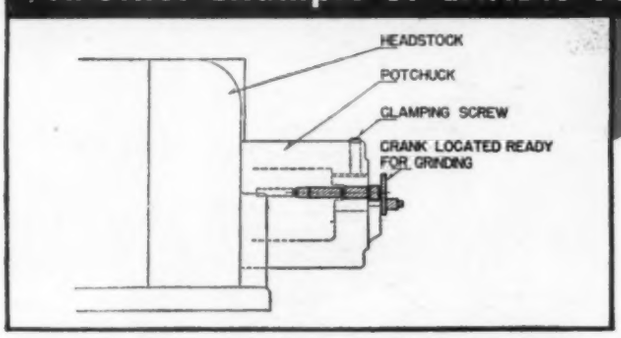
That's why tool men who need more capacity at lower costs are ordering the No. 22 Universal. We are making *immediate* deliveries from stock — *now!* Write for bulletin No. A-186 or see your nearest Covel dealer.

COVEL
INDUSTRIAL GRINDERS

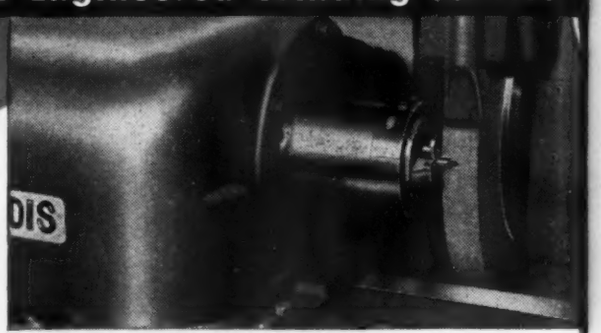
2 GRINDING JOBS ON O



Another Example of LANDIS TOOL Engineered Grinding Service



Crank inserted in pot chuck and rotated for location radially



Crankshaft held in pot chuck ready for crank pin grinding

Grinding this small crankshaft would ordinarily require two machines.

Landis Tool grinding engineers suggested that both between centers and chucking grinding operations could be done on one machine by use of a pot chuck. This resulted in a 40% reduction in machine investment, less work handling and greater output per man.

The 4" Type H Plain Hydraulic Grinder which was selected has these Landis Tool features that permit high production, fine finishes and close accuracy:

Microsphere Wheel Spindle Bearings
Dynamically Balanced Rotating Parts
Variable Voltage Headstock Drive
Stress Relieved Annealed Castings

Landis Tool Engineered Grinding Service will help you solve your grinding problem with the lowest cost solution to meet your requirements. Get in touch with your Landis Tool representative or write us full details. 53

LANDIS TOOL

Precision Grinders

LANDIS TOOL COMPANY

ONE MACHINE

SAVES
40%
Machine Investment

4" Type H Plain Hydraulic Grinder. Special Equipment: Combination live and dead spindle headstock, swing raised to 8", pot chuck. (Catalog A44).

LANDIS TOOL *Company*

WAYNESBORO, PENNA.

Round
Parallel
Straight
Accuracy
Fine Finish
High Production
=Bryant Method
The Bryant Method offers an answer to any internal grinding problem you may have. With a complete line of grinders, plus an enviable background in engineering, Bryant has a combination that can produce parts with true straightness, parallelism and roundness—with a surface finish to millionths of an inch. And, at a production rate that is worth boasting about.
A good example of a Bryant solution for a tough internal grinding problem is shown at the left. The parts are *hardened* steel rings. They meet all required tolerances for roundness, straightness, parallelism and surface finish. The Bryant method allows rough and finish grinding with the same wheel, thereby eliminating further operations formerly necessary to obtain true accuracy and fine finish.
We know your problem is different . . .
but as long as it involves internal grinding and has as its objective high production of parts to very close tolerances, you should consult a man who makes a specialty of solving such problems . . .
Send for the Man from Bryant!
Series 112
Series 16
Series 24
BRYANT CHUCKING GRINDER CO.
SPRINGFIELD, VERMONT, U. S. A.
BRYANT
BRYANT

DoALL *All-Purpose* GRINDING WHEELS

for *all* grinding jobs

At last! One wheel for ***ALL*** Grinding requirements in the average shop — Rough grind with it — Finish grind with it—Grinds any metal—Especially fine for the new super-hard alloys—Removes material 3 to 10 times faster than ordinary wheels—Lasts 5 to 12 times longer—Requires dressing 1/3 to 1/10 as often—Open structure reduces heating and minimizes loading—Can be used on all existing types of grinding machines.

Let this tough, long-life ***ALL-PURPOSE*** Grinding Wheel save you man hours — reduce your inventory of grinding wheels. For full information just ask for the DoALL Grinding Wheel Circular, or better yet, phone or write your nearest DoALL sales and service store for a demonstration.

DoALL OFFERS EVERYTHING FOR SURFACE GRINDING
Hydraulic Precision Surface Grinders—Electromagnetic Chucks — Selectrons — Soluble Oils — Coolant Systems — Dust Collectors — Wheel Dressing Diamonds—Form Dressers—Grinding Wheels

The DoALL *Company*

DoALL STORES
IN PRINCIPAL CITIES

MACHINE-TOOL DIVISION
MINNEAPOLIS 4, MINN.

Have You Checked Up Recently on Your Carbide Tool Grinding Jobs?

NORTON ABRASIVES

Should Your Diamond Wheels Be Vitrified, Metal, or Resinoid Bonded?

Should Your Silicon Carbide (CRYSTOLON) Wheels Be Regular or Open Structure?

FROM the Norton line of diamond wheels you can select the right bond for each of your carbide grinding jobs — cutting blanks, sharpening single-pointed tools, grinding chip breakers, sharpening multi-blade cutters. And there's a complete line of Crystolon wheels, too, for your grinders using silicon carbide wheels.

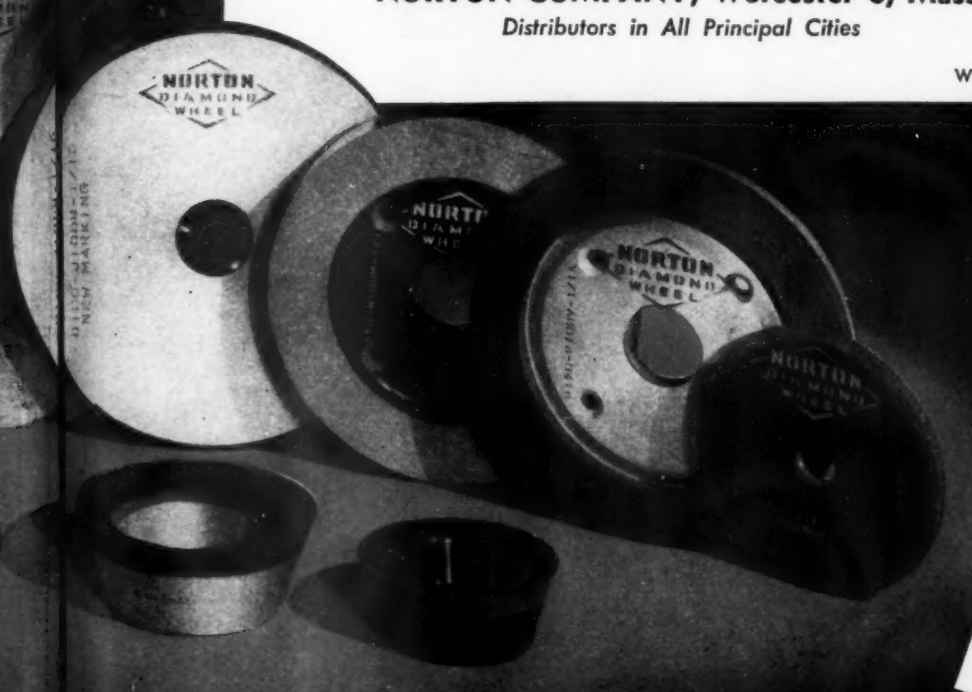
Norton has always been first in diamond wheels — first with resinoid bonded in 1934, first with metal bonded in 1939 and first with vitrified bonded in 1944. There's a definite field for each of these three types — and for Crystolon wheels.

Your Norton abrasive engineer or your Norton distributor's abrasive specialist will be glad to help select the most suitable wheel for each of your carbide grinding jobs.

NORTON COMPANY, Worcester 6, Mass.

Distributors in All Principal Cities

W-1068



Norton Diamond or Crystolon Wheels are Available for All Makes of Carbide Tool Grinders, including:

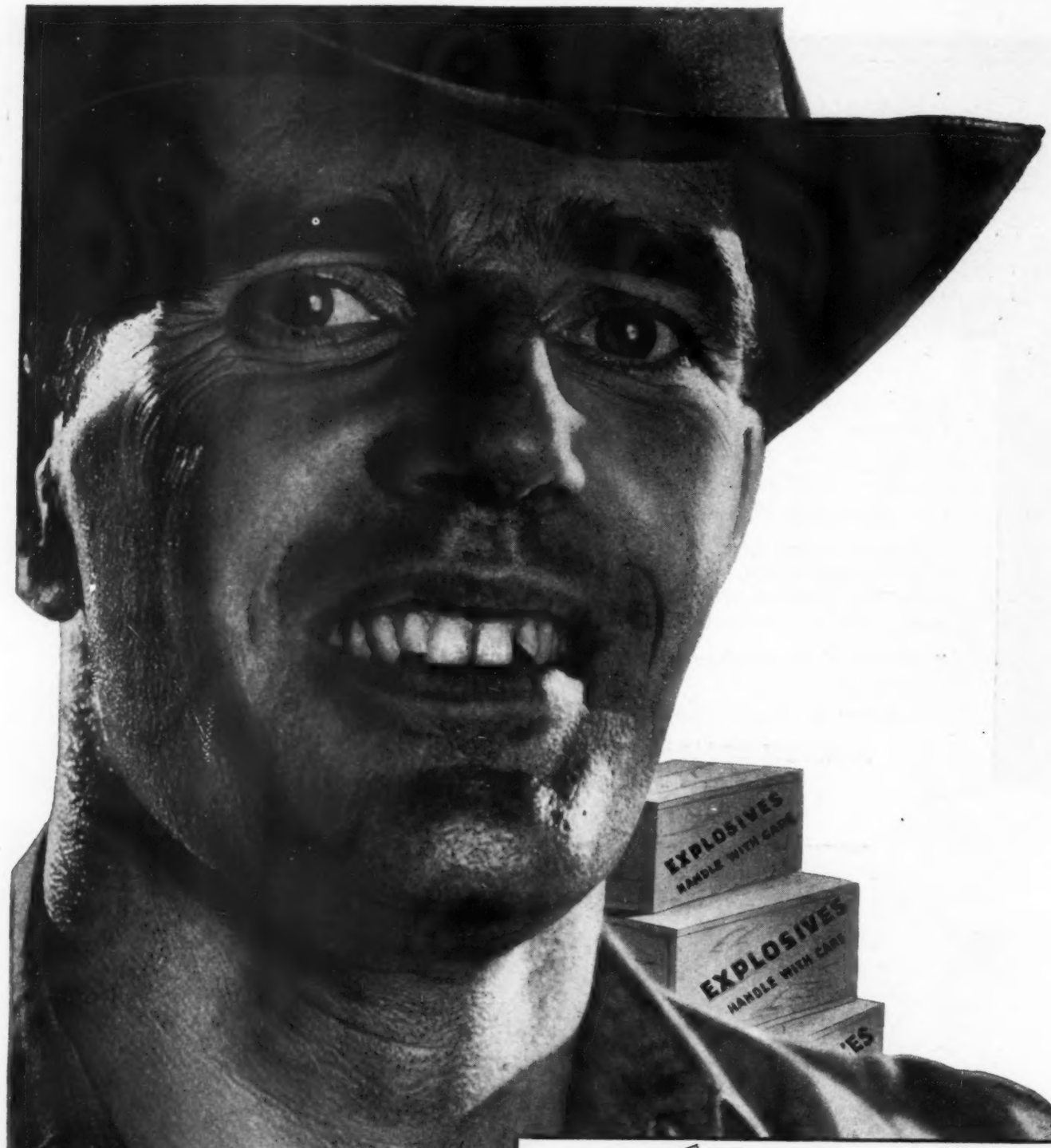
Baldor
Blount
Norton Bura-way
Carboloy
Criterion
Delta
Ex-cell-o
Hager
Hammond
Heald
Lee
Oliver
Prosser
Sundstrand
Willey

Also for All Makes of Tool and Cutter Grinders.

There are Norton metal bonded diamond saws and vitrified, resinoid and metal bonded diamond wheels for glass, quartz and stone.

NORTON ABRASIVES

T. M. Reg. U. S. Pat. Off.



Send for this New Special-Purpose Drill Folder

Shows and describes many MORSE Special-Purpose Drills. Brings you up to date. And if you don't see what you need—*ask for it!* MORSE HAS IT!

"It's T.N.T"

. . . but MORSE found the way to *Drill it* without Striking a Spark

DEADLY PROBLEM was this one! But Morse . . . drawing on the lengthiest drill experience in the world . . . developed a special non-sparking drill of phosphor bronze that pulls the dreaded teeth of T.N.T—at least as far as drillers are concerned.

Now this follows: No matter what *you* drill . . . asbestos, T.N.T., steel or zylonite . . . there is *one* Morse Drill (of the right type, metal, diameter, length and twist cut) that will do your job better than any other. *Are you using it now?* Ask your Industrial Supply Distributor for a Morse recommendation.

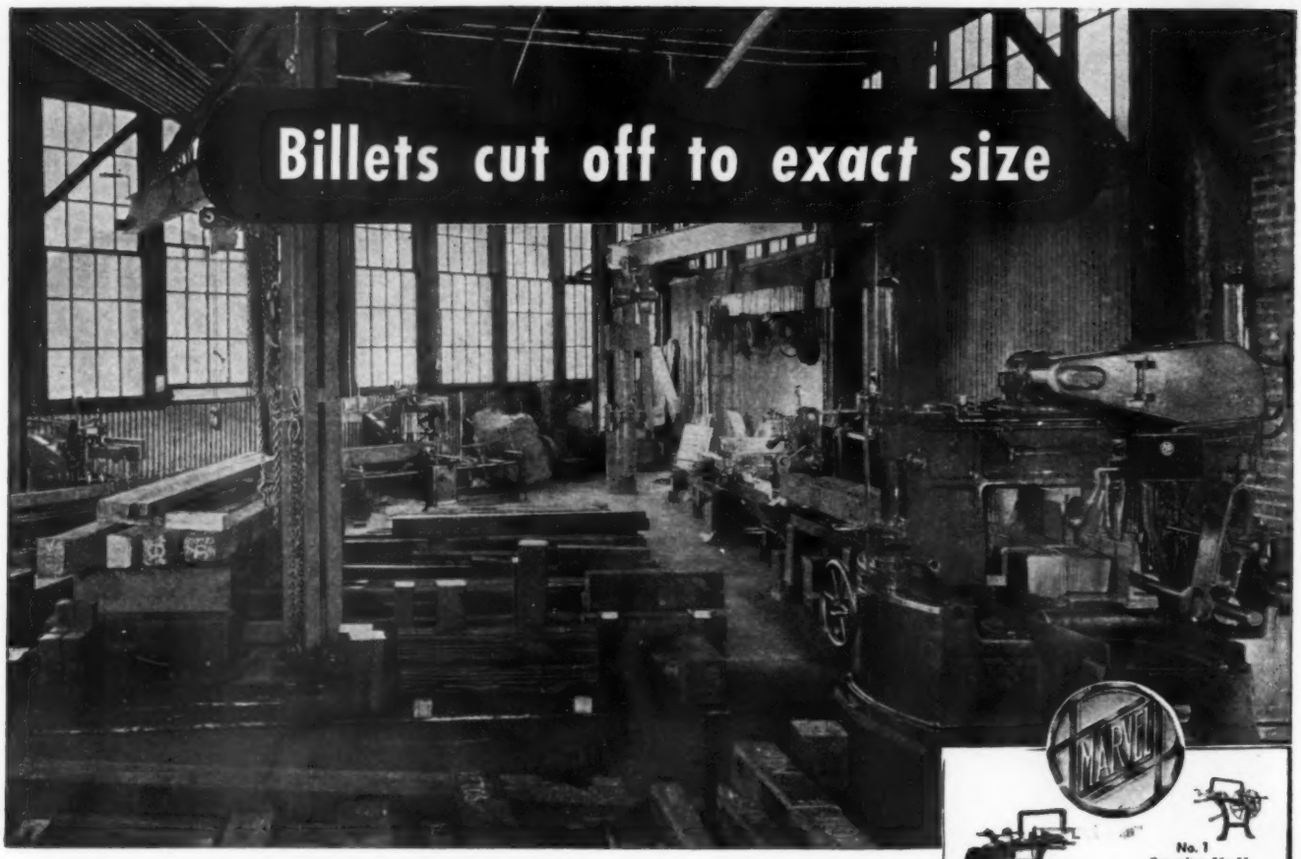
Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture

MORSE TWIST DRILL & MACHINE COMPANY

The Original Manufacturer of Twist Drills

NEW BEDFORD, MASSACHUSETTS

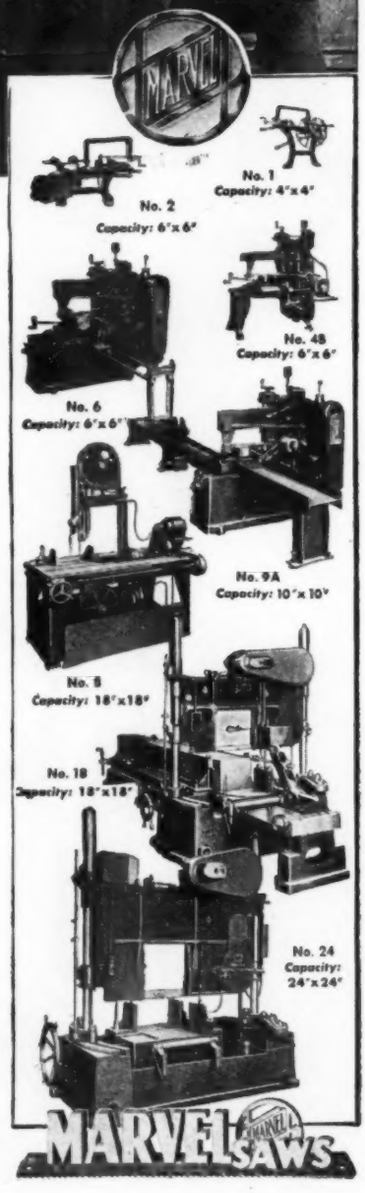
NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.



ANY QUANTITY CUT-OFF AUTOMATICALLY

These MARVEL Saws are money makers for this modern forge shop in many ways. (1st) they cut off billets for a small fraction of the cost of cutting-off with a hammer. (2nd) these billets are so accurate in size that they exactly fill the dies with no excess fin, not only simplifying trimming and finishing, but getting extra billets from many bars. (3rd) they keep all hammers busy on *production* work for these "world's fastest" saws can keep ahead of any schedule. (4th) they reduce cutting-off labor costs to an absolute minimum. It takes only one operator and a helper to keep all of these saws running because all but the No. 18 Giant Hydraulic Saw (at the right) are *automatic* —feed measure, and cut-off identical billets; requiring no more attention than automatic screw machines.

Your local MARVEL Sawing Engineer will gladly call and explain how you can add these five extra profits to your forge operation.



ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE **CHICAGO 39, U.S.A.**

Eastern Sales Office: 225 LAFAYETTE ST., NEW YORK 12, N. Y.

MARVEL SAWS

The CONE AUTOMATIC MACHINE COMPANY

sees many

GOOD THINGS AHEAD

It is reported that . . . . . .

President Buckley of Bell Telephone Laboratories describes a television tube no bigger than a pocket flashlight.

get ready with CONE for tomorrow

The new building of the American Stone Company in St. Louis will have an electrically controlled car suspended from the roof for washing windows.

get ready with CONE for tomorrow

A plastic molding press weighing 17 lbs. and costing about $30 is offered by N. R. K. Manufacturing & Engineering Company of Chicago.

get ready with CONE for tomorrow

International Business Machines has a 6-key Braille typewriter and will give away the first thousand to blind veterans.

get ready with CONE for tomorrow

Du Pont has announced a new, improved translucent "metallic" lacquer for automobiles called "Metalli-Chrome"

get ready with CONE for tomorrow

Two former military pilots have established American Flyaway Service, at Dayton, Ohio, to deliver personal aircraft from manufacturers to dealers.

get ready with CONE for tomorrow

On its longest over-water run, Oakland to Honolulu, Naval Air Transport Service is landing its planes within 18 minutes of their schedule.

get ready with CONE for tomorrow

In the upholstery plant of Fisher Body, the annoyance and danger of static electricity was eliminated by humidification. An incidental benefit was reduced absence due to colds.

International Harvester is establishing a manufacturing research center with 350 men chosen from its plants all over the country.

get ready with CONE for tomorrow

Westinghouse has a bacteriacidal ultra-violet lamp to insert in milk cans that reduces bacteria count 96% in one minute.

get ready with CONE for tomorrow

The 6-mile canal dredged to supply the Dow magnesium plant at Velasco, Texas, with sea water is also serving as a freight artery.

get ready with CONE for tomorrow

Tucson Laundry Company has started twice-a-week laundry pick-up service by air over a distance of 60 miles.

"ENIAC", the electronic computor developed for the Ordnance Department, can do 100 man-hours of mathematical work in two hours. It is expected to revolutionize the mathematics of engineering.

get ready with CONE for tomorrow

American Optical Company has developed a sight-testing instrument which will make 14 vision tests in three minutes.

get ready with CONE for tomorrow

Beech Aircraft is developing a 6-passenger automobile with a 90-horsepower air-cooled engine that drives a generator powering separate electric motors on the wheels.

get ready with CONE for tomorrow

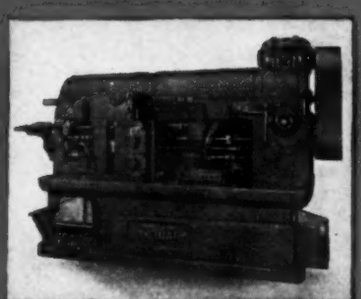
Martin Senour Company has developed a method of paint mixing that will produce 1000 tints with accuracy from 6 basic colors. The idea is being tested at a "paint bar" in a metropolitan department store.

COMPLETELY

PROFITABLY

The brass fitting illustrated is machined on a ⅞" 4-spindle Conomatic in 6 seconds. For machining parts completely and profitably, purchase Cones.

Ask your CONE *representative to show you our new color motion picture*



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

32

Which Abrasive is right for the Job?

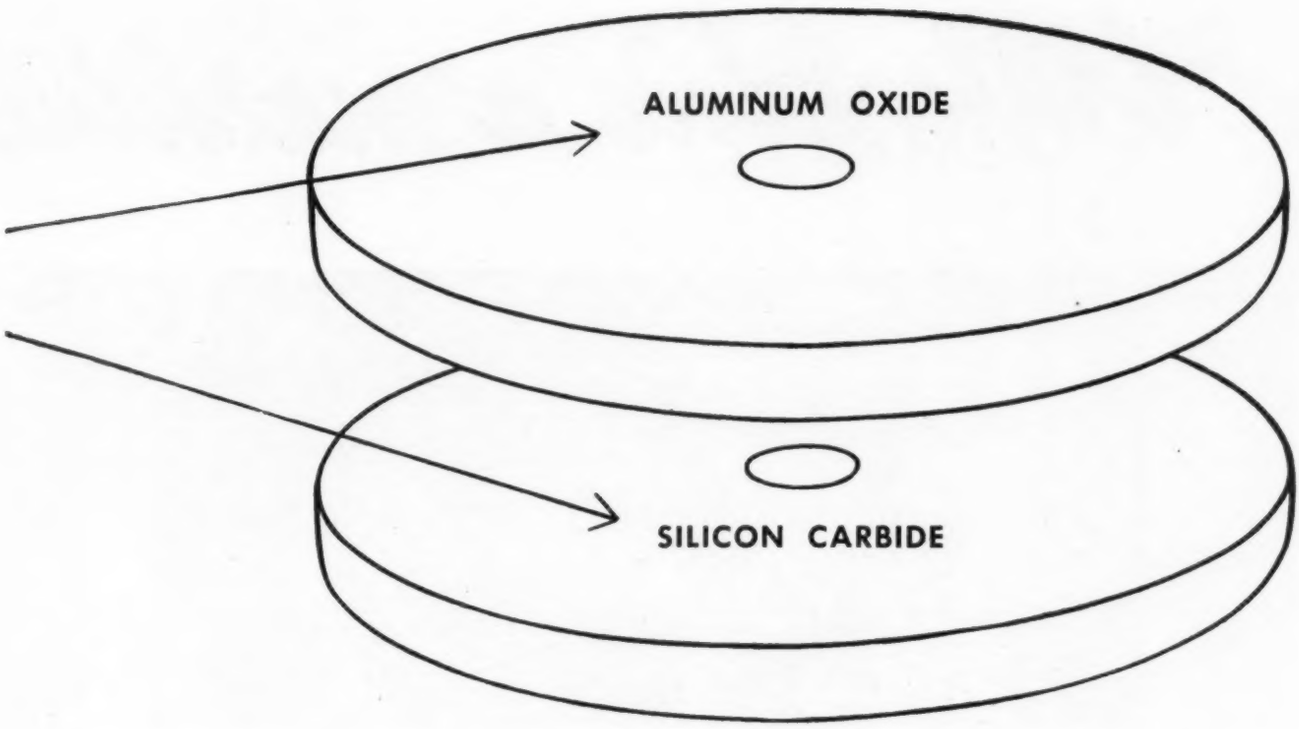
When adequate consideration is given grinding cost figures accounted for in wheel life, man hours, power consumption, volume and quality —selecting the best abrasive to use assumes new importance.

Aluminum Oxide and Silicon Carbide are the two most widely used abrasives. In many respects, characteristics of each differ widely. The degree of variation is further extended in the many modifications of each type.

To choose one of these types of abrasives only on the basis of the material to be ground is not enough. Other variables affect the selection. Among these are contact area of wheel and work, amount of stock to be removed, and type and condition of the grinder.

To render practical aid in correctly evaluating these and other factors, as well as to serve as a double check on your choice, The Carborundum Company has organized a system which many

A good rule for good grinding... **CALL**



successful concerns depend on for improved grinding, at lower cost.

A CARBORUNDUM salesman or our distributor's representative is your first contact with this system. These men personally can offer worthwhile suggestions based on a knowledge of current abrasive developments, plus plenty of on-the-job experience.

When the problem calls for an unusual solution, one of our Abrasive Engineers is called in. A trained specialist, he is supported by the findings of the world's best known abrasive laboratories.

Because you are interested in better grinding at lower cost, it makes sense to take advantage of this practical, easy-to-use service. Whenever you have an abrasive question, feel free to call in CARBORUNDUM. Your inquiries are always welcome. The Carborundum Company, Niagara Falls, New York.

IN CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
- Silicon Carbide
- Aluminum Oxide
- Diamond

Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

for:

Polishing
Lapping
Pressure Blasting
Finishing

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

When does a machine

tool become Obsolete?

A MACHINE TOOL BECOMES OBSOLETE THE MINUTE YOUR COMPETITOR STARTS USING A BETTER MACHINE TOOL FOR THE SAME PURPOSE!

★ Age does not determine machine tool obsolescence. From 1930 to 1940 the proportion of machine tools in industry over 10 years old averaged 60%. *Many of these old machines served adequately under conditions existing at that time.*

Since 1940, however, nearly 6 times as many machine tools have gone into productive service in this country than were built in the 5 years previous to 1940. Many private companies are converting to peacetime production aided with new, improved machine tools purchased during the war period or acquired from government-owned surplus stocks. These modern machine tools give these companies marked advantages in producing faster, at lower cost.

If you are heading into the future with machine tools that are not so productive as those of your competitors, you have machine tool obsolescence —a handicap which may be reflected in your next year's financial report.

A Warner & Swasey field engineer can suggest accessories and new tooling setups to increase productivity of your old turret lathes, or advise the right types of Warner & Swasey Machine Tools to replace those which are definitely obsolete. Write Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

WARNER & SWASEY Machine Tools *Cleveland*

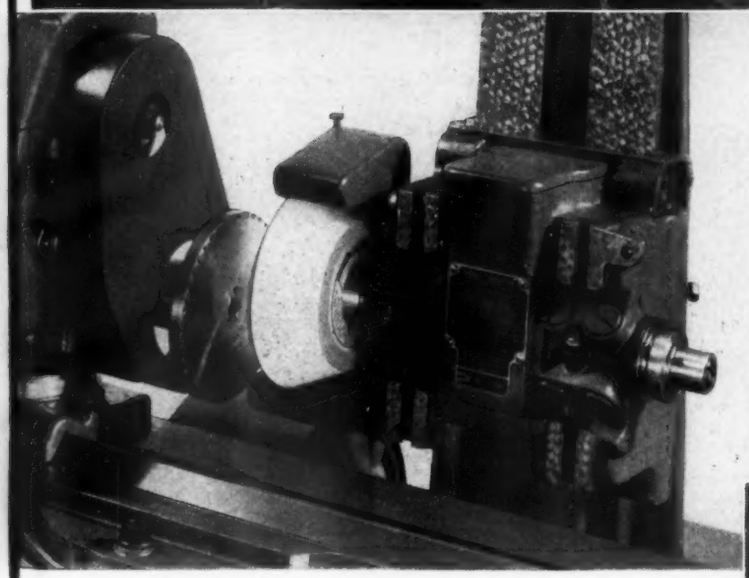
TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

A versatile machine that does "fussy" jobs unusually well

No. 13
UNIVERSAL AND TOOL GRINDING MACHINE

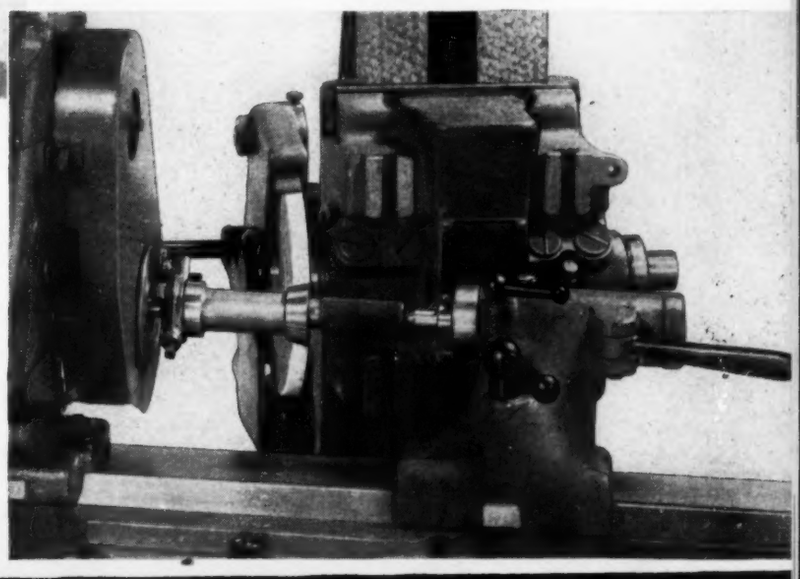
Here's a machine that saves time every working day. Set-ups and change-overs are made easily and quickly – work is done efficiently and accurately. Highly versatile, the No. 13 handles the common, every-day jobs such as rapid sharpening of cutters, reamers and other cutting tools, cylindrical grinding and general purpose toolroom grinding. For operations where a large amount of one type of work is required special attachments and equipment are available. This equipment includes hob, face mill, end mill, and formed cutter sharpening attachments – surface, internal, wet grinding and exhaust attachments

BROWN &



The universal head with the swiveling adjustments of the table and of the wheel spindle upright, provides accurate settings for precise sharpening of a wide variety of cutters.

Thin work such as small saws, thin cutters, disks, washers, etc., which can be held in face chuck, are easily face ground by revolving-spindle grinding.



Either "live" or "dead" center grinding of cylindrical work . . . straight or taper . . . is equally easy. Wet grinding attachment, furnished as an extra, supplies coolant for grinding work up to 6" diameter.

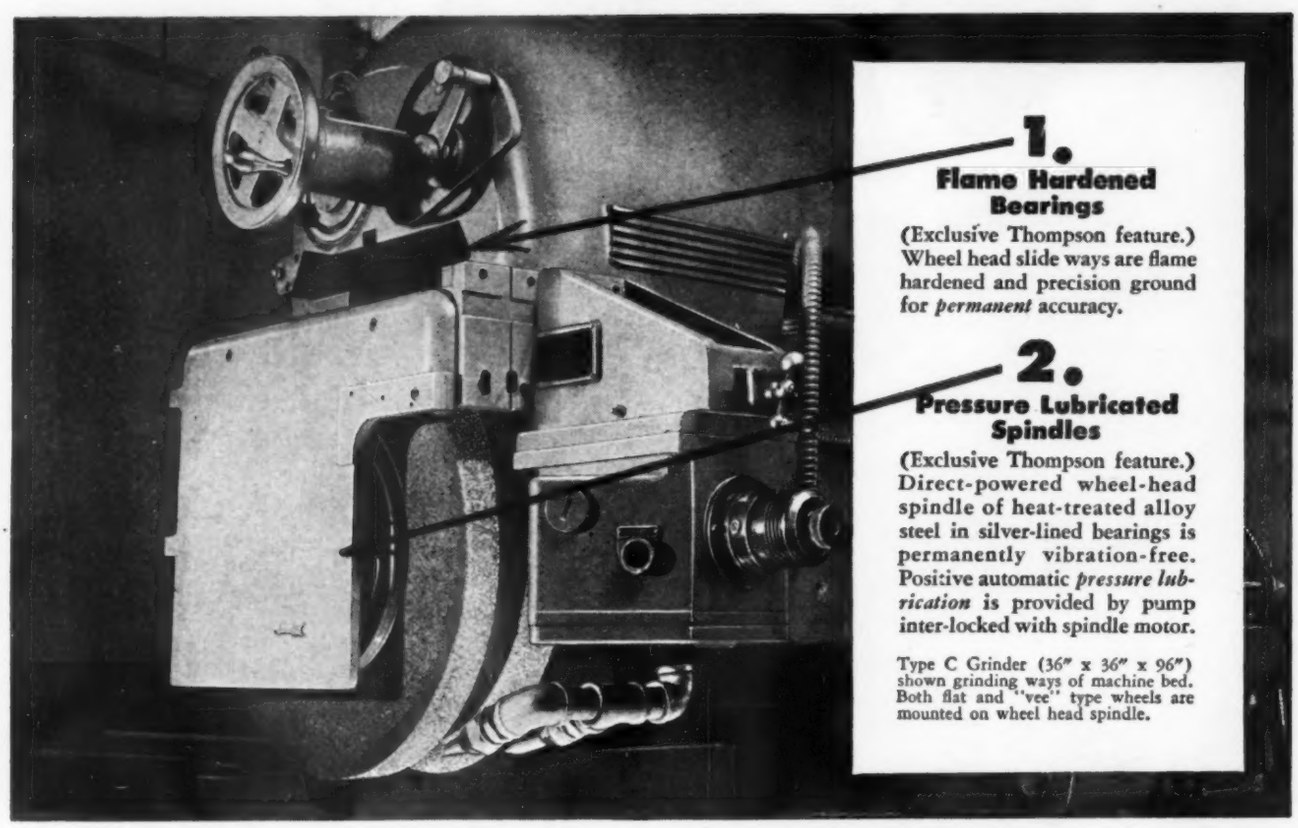
Write for detailed specifications.

Brown & Sharpe Mfg. Co.
Providence 1, R. I., U. S. A.

B·S

G SHARPE

Only Thompson provides all these cost-saving developments!



1. Flame Hardened Bearings

(Exclusive Thompson feature.) Wheel head slide ways are flame hardened and precision ground for *permanent* accuracy.

2. Pressure Lubricated Spindles

(Exclusive Thompson feature.) Direct-powered wheel-head spindle of heat-treated alloy steel in silver-lined bearings is permanently vibration-free. Positive automatic *pressure lubrication* is provided by pump inter-locked with spindle motor.

Type C Grinder (36" x 36" x 96") shown grinding ways of machine bed. Both flat and "vee" type wheels are mounted on wheel head spindle.

3. Automatic Wheel Truing (pioneered by Thompson). The stationary truer provides instant availability of the truing tool. All wheel head slides are now equipped with hydraulic wheel truing feeds. It is not necessary to disturb the work piece in order to true the wheel.

4. Angular Wheel Truing (pioneered by Thompson). Attachment equipped with two truing tools, both sides of the included angle are trued simultaneously. Universal motor with speed variation 5" to 40" p.m. controlled by governor insures accurate, smooth truing for fine finish and precision on work piece.

5. Automatic Down Feed (exclusive Thompson feature). Feed cycle of .00025" to .004" is available at each table reversal for plunge cutting or at each wheel head feed reversal. Feed mechanism has automatic trip—can be pre-set for size control from elevating hand wheel graduations, duplicating accuracy to .0002".

6. Automatic Sparkout Control (exclusive Thompson feature). Allows table and wheel head to continue finishing cuts after automatic down feed device has reached pre-determined size. At fixed time after work size is reached, table rapid traverses to loading position and stops automatically. Usually furnished in conjunction with automatic down feed. This device maintains accurate duplication of dimensions and makes possible battery installations by releasing operator for loading other machines.

7. Anti-Friction Elevating Unit (exclusive Thompson feature). Friction between screw and nut is reduced 70% to permit accurate feeding to .0001". Also minimizes effort of moving saddle assembly when making new setups without power elevation. Permits inexperienced operators to finish work by following handwheel graduations.

8. Double-Length Bed (exclusive Thompson feature). Massive *double-length* solid-cast beds are provided with heavy cross-section and numerous ribs at vital points to provide absolute rigidity for table.

• • •

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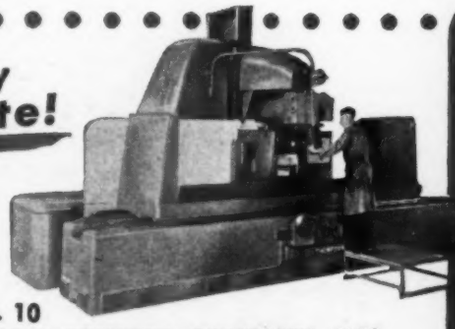
THE THOMPSON GRINDER CO. INC.

Before you buy *investigate!*



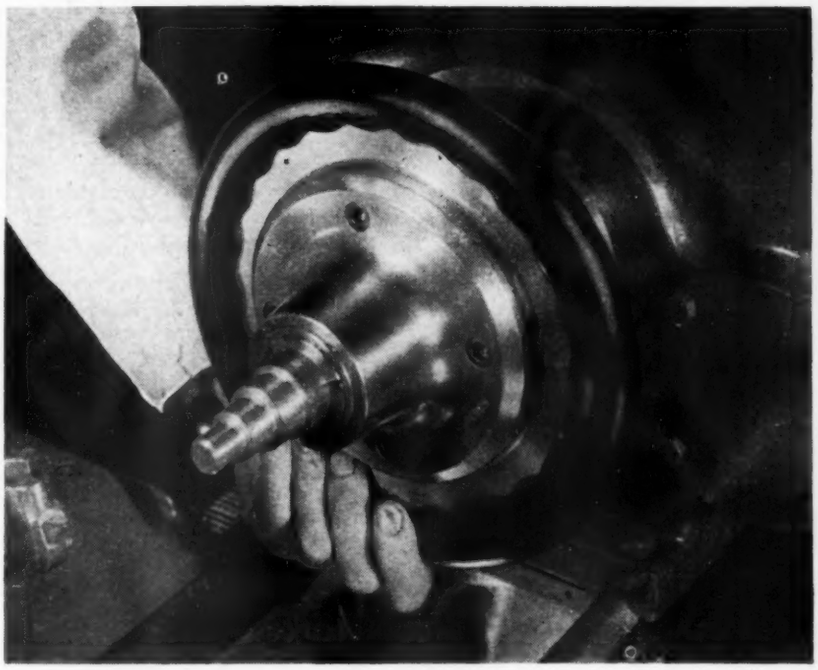
Thompson SURFACE Grinders

Address Dept. 10
THE THOMPSON GRINDER COMPANY, INC.
SPRINGFIELD, OHIO

HARDINGE
ELMIRA, N.Y.

The Right Combination for Increased Production

Hardinge-Sjogren Speed Collet Chucks and Hardinge Precision Collets

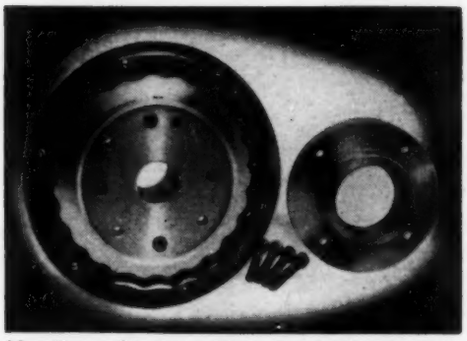


Hardinge-Sjogren Speed Collet Chucks and Hardinge Precision Collets together mean increased production.

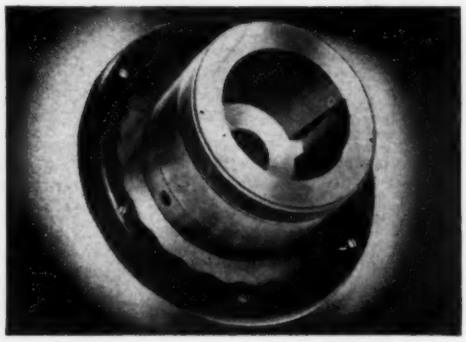
Hardinge-Sjogren Speed Collet Chucks give greater collet capacity and speed production. Available in three sizes, 1", 1⅜" and 1¾" collet capacity, and readily adapted for use on threaded nose, tapered-key drive, or cam lock spindles. An almost effortless turn of the wheel opens and closes the collet to release or grip the work as desired.

Hardinge Precision Collets symbolize accuracy, durability, and low price. They are made of special steel, uniformly heat treated, with hardened surfaces and spring temper for proper operation.

With such sure and easily adjustable holding of work, time is saved, accuracy increased and results are better. For full value from your tool room lathes, engine lathes and milling machines, equip with Hardinge-Sjogren Speed Collet Chucks and Hardinge Precision Collets.

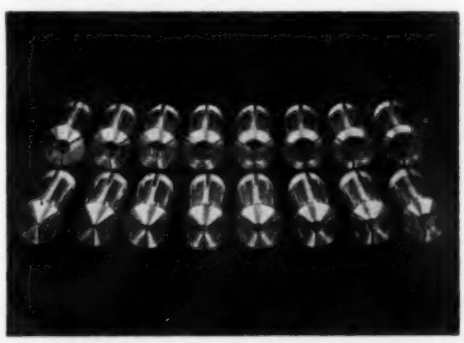


Hardinge-Sjogren Plain Back Chuck with Adapter plate for Machines with Threaded Spindle Nose.



Hardinge-Sjogren Chuck for Lathes with Tapered Key-Drive Spindle Nose.

Hardinge-Sjogren Chuck to fit directly on Lathes with Cam-Lock Spindle Nose.



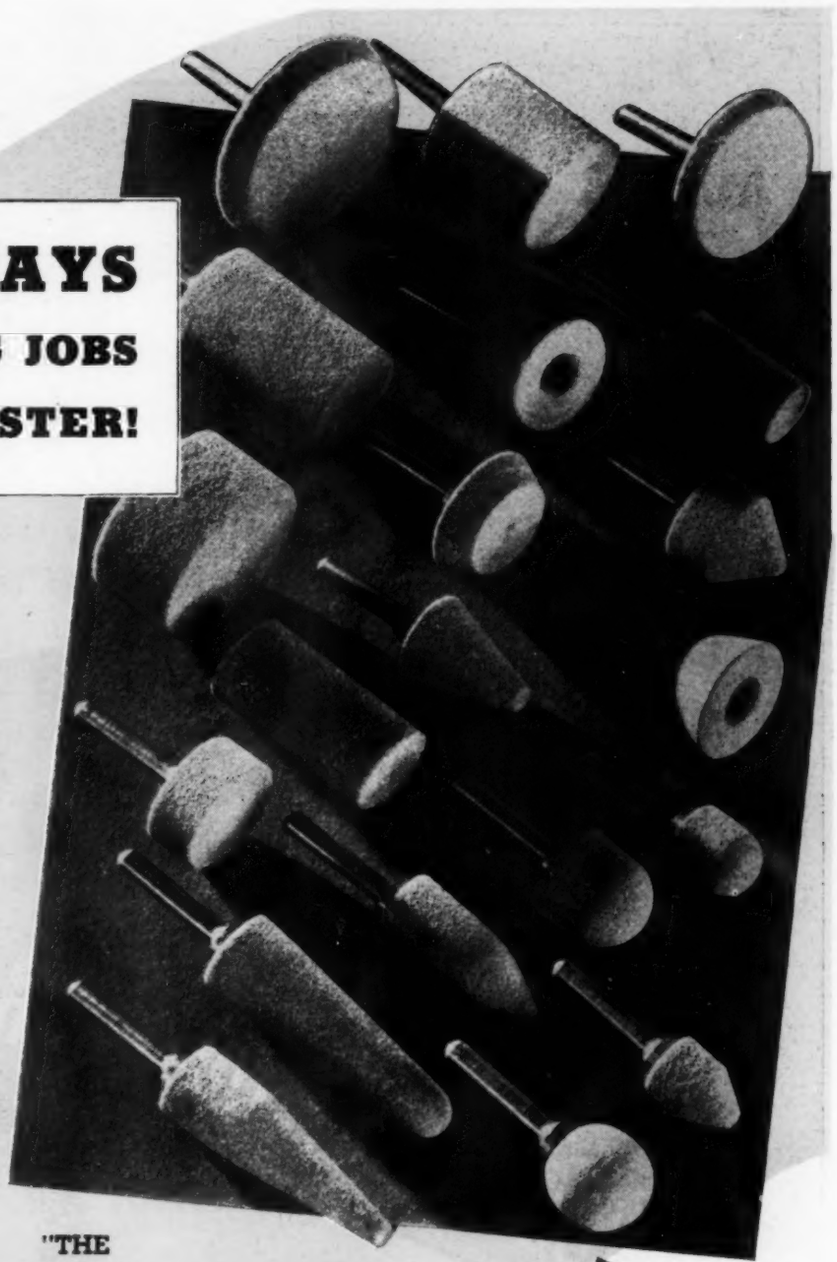
Hardinge Precision Collets are available in a wide range of sizes; carried in stock in Elmira and other industrial centers.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Congratulations
TO THE
Automotive Industry
FOR 50 YEARS OF
OUTSTANDING DEVELOPMENT
● Sidney recognizes the great advance that has been made in production—in design—in utility by that industry and pays tribute to it for outstanding service to the nation.
Sidney, like the automotive industry, has made noteworthy progress in the development of lathes over the past 43 years.
It's a great stride from the cone driven lathe of yesteryear to the latest Continuous Tooth Herringbone geared head machine of today. This new lathe is designed and built with all the power—speed—and rigidity required for the successful use of carbide cutting tools.
With the high production demands of the future in mind —investigate Sidney Lathes for your next investment in precision machine tools. Bulletins on all sizes available.
Builders of Precision Machinery
THE
SIDNEY
MACHINE
TOOL COMPANY
SIDNEY • OHIO
SIDNEY
ESTABLISHED 1904

TWENTY WAYS
TO DO GRINDING JOBS
BETTER AND FASTER!



STERLING'S STERMOUNTS offer positive solutions for your perplexing, difficult grinding and polishing jobs. The twenty shown to the right are but a few of many shapes and sizes which are available to use in those hard-to-get-at locations where good grinding seems impossible.

Sterling's Stermounts are made in both vitrified and resinoid bonds to widen their usefulness for grinding all types of metals . . . they have the correct outlines to fit into all types of holes and recesses.

Sterling's Stermounts have the added advantage of removable spindles that can be used over and over again. These spindles are made in two sizes to add extra rigidity and safety to the Stermounts when they are in use.

Sterling's Stermounts hold their cutting qualities and do a quick job on all kinds of metals without undue pressure being exerted. They are sturdy and tough . . . provide long grinding life.

Want to cut costs with Stermount? Drop us a line today, and we will tell you how to do it.

"THE WHEELS OF INDUSTRY"

Sterling

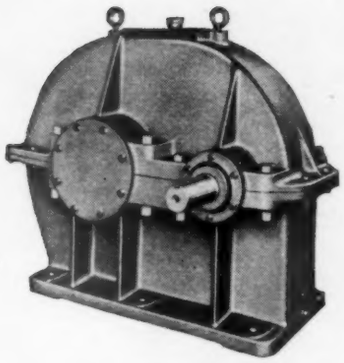
● The complete Stermount line of wheels and shapes is shown in this attractive folder which is available for distribution. Send for your copy . . . it gives measurements and prices of each type . . . describes the spindles, too!

· STERLING ABRASIVES ·

THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

IF YOU'RE NOT THE FIFTH . . .
you'll profit 6 ways
from this packaged drive
WESTINGHOUSE
MEMBER OF
AGMA



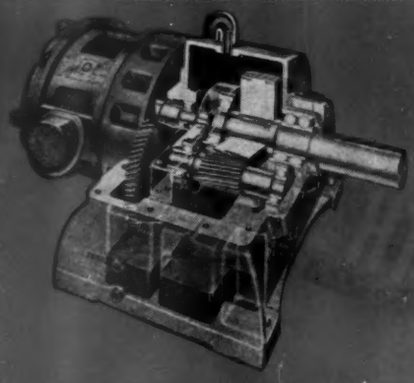
This Type SH speed reducer is a single-reduction unit which is furnished in thirteen standard ratios in each of twelve sizes. The Type DH speed reducer, which is a double-reduction unit, is offered in fifteen standard ratios in each of twelve sizes.

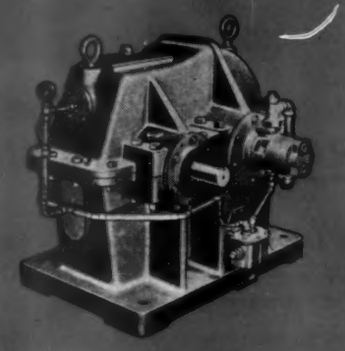
Because 4 out of 5 machines operate at slower speeds than their prime movers supply, you stand to gain six ways when you put Westinghouse speed reducers to work for you:

1. You step up power efficiency (one plant raised it from 80.9% to 85.4%).
2. You reduce frequent servicing of open-type drives to semi-annual lubrication of a packaged unit.
3. Maintain positive alignment of drive and driven machine.
4. Long service life through single helical gearing heat-treated by the exclusive Westinghouse BPT process.
5. Minimum power loss with anti-friction bearings.
6. Precision operation from hob-cut gears.

For drives up to 1,000 hp, you have your choice of twenty-four sizes of Westinghouse speed reducers—Types SH and DH—for speed reduction ratios from 2.82 to 70.5 . . . and you get all the benefits of unit responsibility with motor and gears supplied by one manufacturer.

Get all the facts today from your nearest Westinghouse office on the advantages you'll gain when you use these matched unit drives for all types of speed reduction. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-07251





FOR DRIVES FROM 1 TO 75 HP CHOOSE GEARMOTORS

These efficient, economical gearmotors give you the best in modern speed reduction for drives from 1 to 75 hp. Easy to install, simple to service and adaptable for all types of drives and motors. Three types—A, C and E—are available and provide output speeds of 1,450 to 16.5 rpm. All unit types can be used with either single-phase, polyphase or d-c motors.

FOR DRIVES UP TO 2,000 HP AND 9,000 RPM USE THESE SPEED INCREASERS

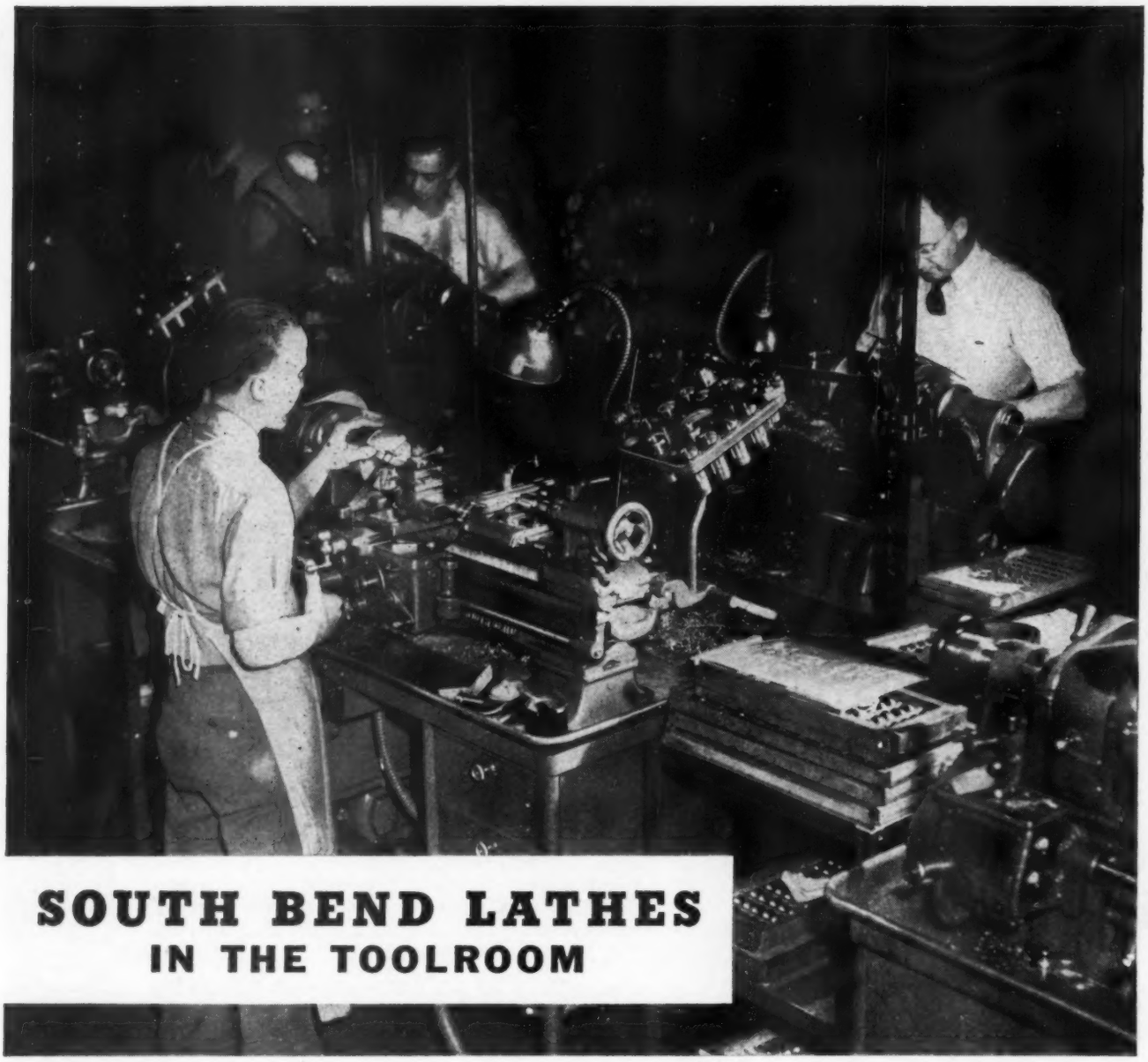
These matched-unit drives have special advantages for all industrial and commercial high-speed jobs up to 2,000 hp and 9,000 rpm. Units are available in 30 sizes with gear ratios of 1.25 to 3.25 up to 2 to 12.

The whole story of industrial geared drives and the way every industry is using them is told in this new book, profusely illustrated with actual applications. Ask for your copy of B-3730 today, on your business letterhead, please.

Westinghouse

PLANTS IN 23 CITIES . . . OFFICES EVERYWHERE

4 out of 5 drives need speed reduction



SOUTH BEND LATHES
IN THE TOOLROOM

WHERE PRECISION AND PERFORMANCE COUNT!

COLLETS FOR SOUTH BEND LATHES
are available from 1/16" to 1" capacity in 1/64" steps. A complete set will help to lower your toolroom costs.

Nowhere in the plant are unfailing precision and dependable performance more important than in the toolroom. It is here—in the "tools that make the tools"—that the quality and cost of the product are largely pre-determined.

The ability of South Bend Lathes to perform a wide variety of precision operations makes them the most valuable and versatile tools in the toolroom. The ease and speed with which they can be changed from one set-up to another is a definite advantage and still another reason for their wide popularity. A complete line of attachments and accessories are available which will simplify your tooling still further. Write today for Catalog 100-D which illustrates in full color and completely describes the complete line of South Bend Engine Lathes, Toolroom Lathes and Turret Lathes.

SOUTH BEND LATHE WORKS
419 EAST MADISON STREET • • SOUTH BEND 22, INDIANA
LATHE BUILDERS SINCE 1906

New rigidity and power for today's cutting materials

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL MACHINES

NEWTON 8 SPINDLE TWO-STATION UNIT HEAD ROTARY MILLING MACHINE

Designed for high production milling of Automotive Cylinder Blocks and heads, transmission cases, and similar parts, this machine is equipped with two sets of roughing and two sets of finishing spindles with operating stations on each side of the machine, making possible twice the productive capacity of the conventional single station machine.

Send us your inquiries

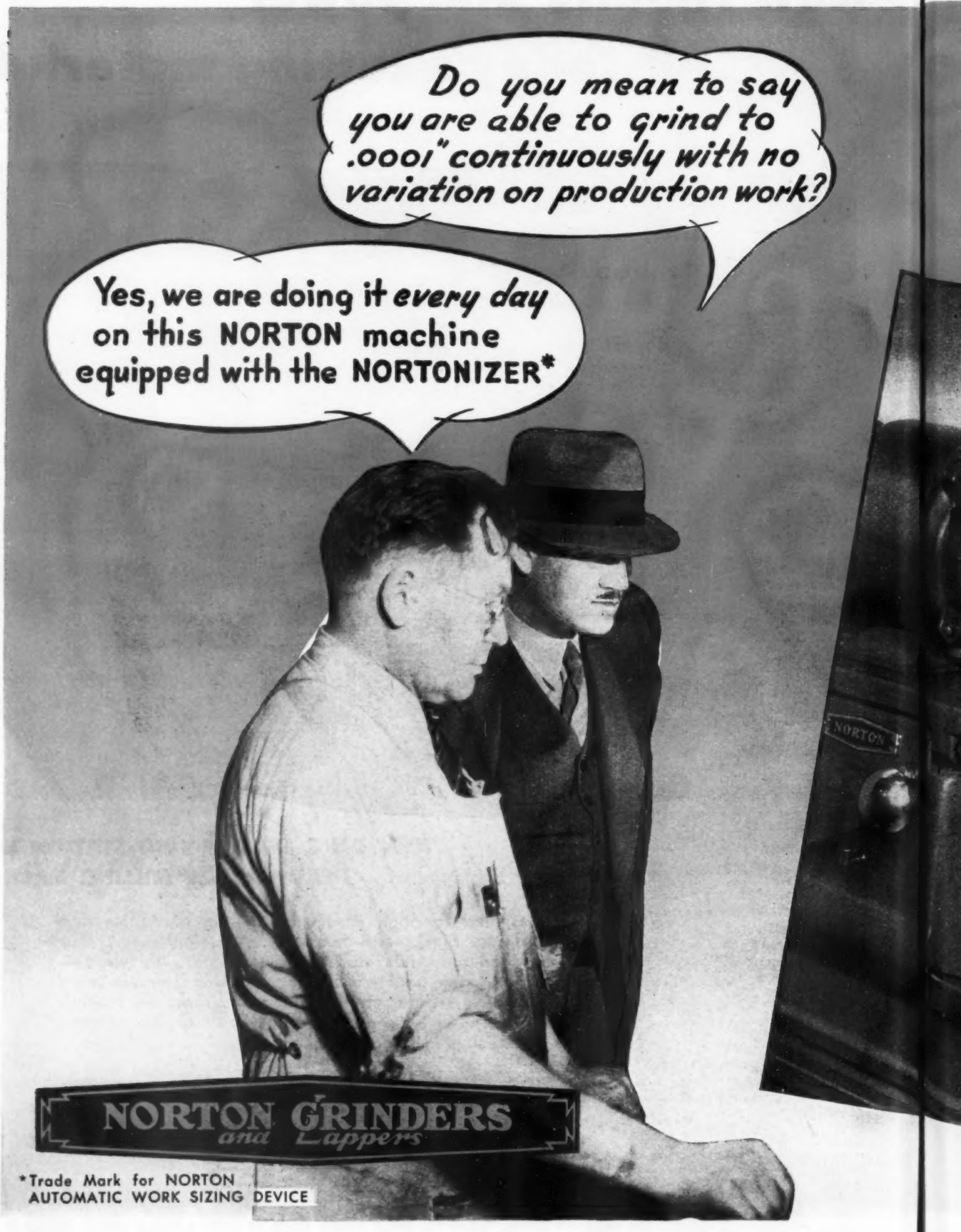
BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

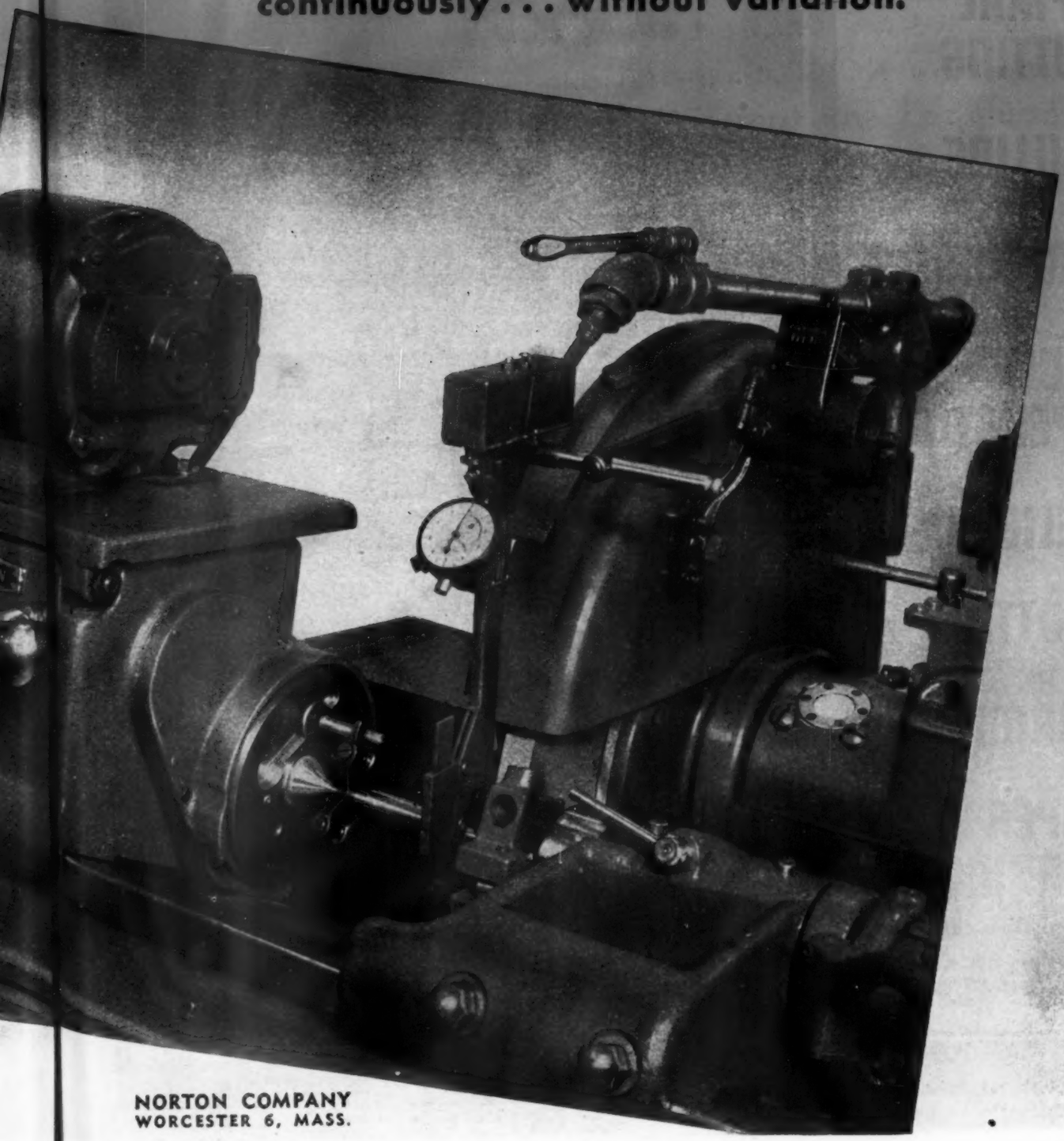
CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK


Do you mean to say you are able to grind to .0001" continuously with no variation on production work?
Yes, we are doing it every day on this NORTON machine equipped with the NORTONIZER*
NORTON GRINDERS
and Lappers
NORTON
*Trade Mark for NORTON AUTOMATIC WORK SIZING DEVICE

THE NORTONIZER*

AUTOMATIC WORK SIZING DEVICE holds cylindrical work within limits of .0001"... continuously... without variation.



NORTON COMPANY
WORCESTER 6, MASS.

M-526

ALL THIS *and*

PRECISION *too*

No. 608 back-geared, screw cutting bench lathe for tool making and instrument shops where handling of a greater variety of jobs in minimum time is important. This small but exceedingly proficient lathe with slide areas equal to that of one twice its size permits the operator to finish his work completely without employing other machines, and, throughout the entire series of operations, utilize the inherent precision of the lathe itself.

WRITE FOR BULLETIN 608

BALL TURNING

SPIRAL CUTTING

MILLING

GRINDING

MULTIPLE OPERATIONS

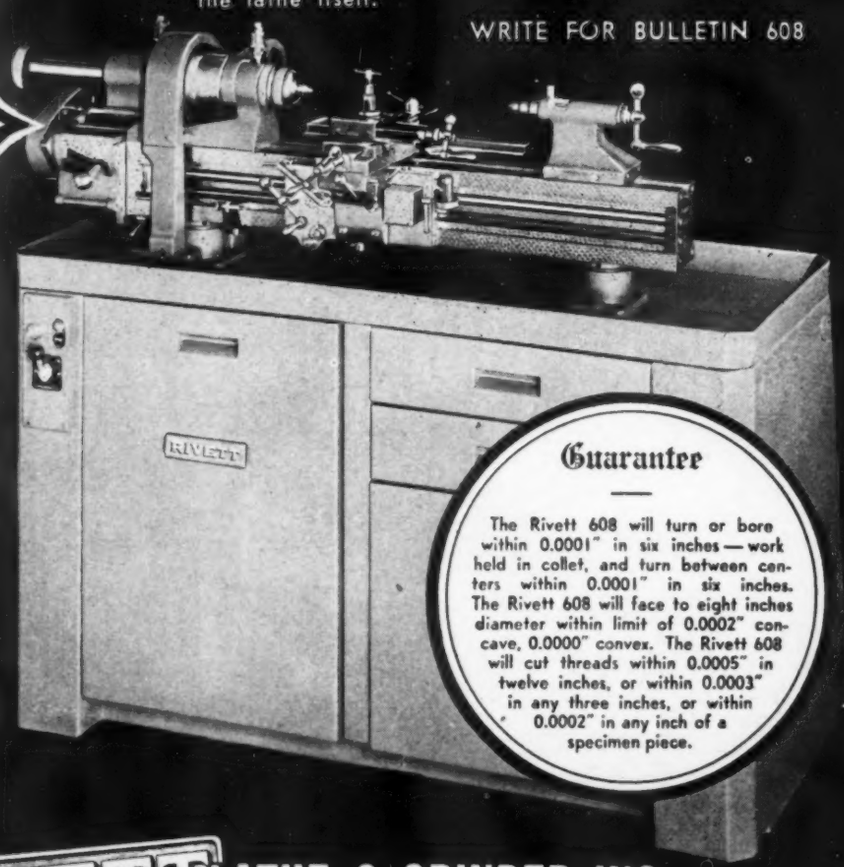
RELIEVING

SLOTTING

FORMING

TAPER TURNING

All possible through precision-made attachments.



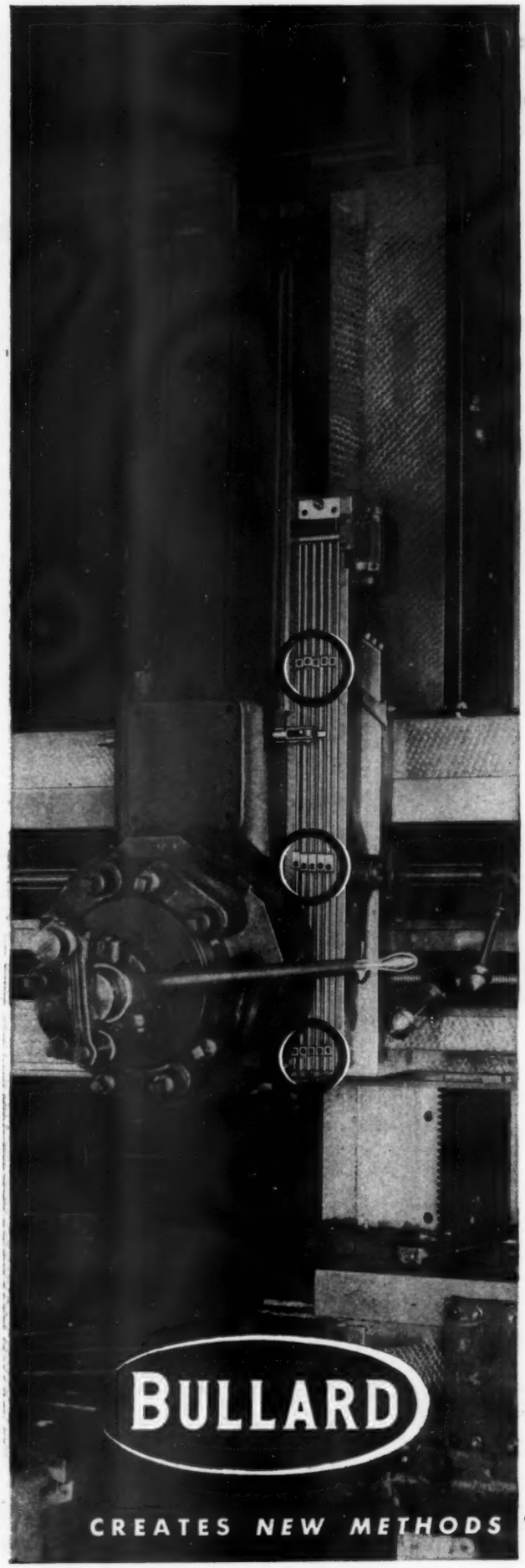
Guarantee

The Rivett 608 will turn or bore within 0.0001" in six inches — work held in collet, and turn between centers within 0.0001" in six inches. The Rivett 608 will face to eight inches diameter within limit of 0.0002" concave, 0.0000" convex. The Rivett 608 will cut threads within 0.0005" in twelve inches, or within 0.0003" in any three inches, or within 0.0002" in any inch of a specimen piece.

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS., U.S.A.

ARMY E NAVY

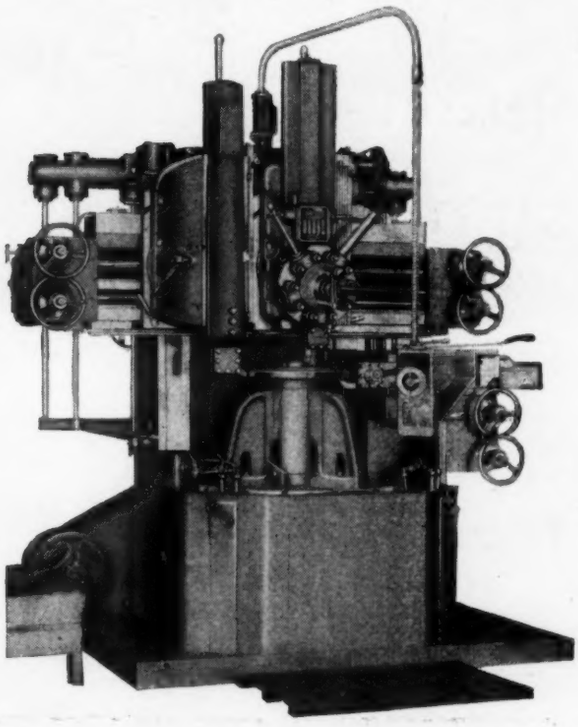


HOW BULLARD CUT MASTERS DUPLICATE DIMENSIONS SAFELY AND CONSISTENTLY

Bullard's skill in applying electrical-hydraulic control systems to machine tools...as exemplified by the Cut Master Vertical Turret Lathe's revolutionary new Pendant Control . . . is further illustrated by Bullard's method of dimension control through electrical and hydraulic feed stops.

On the saddle of each head of the Cut Master V. T. L., Bullard puts accurate adjustable dogs which are set to dimension limits for work size. When contacted by the moving head, they start a train of mechanical, electrical and hydraulic actions that disengage feed... instantly and accurately, thereby providing automatic sizing of work.

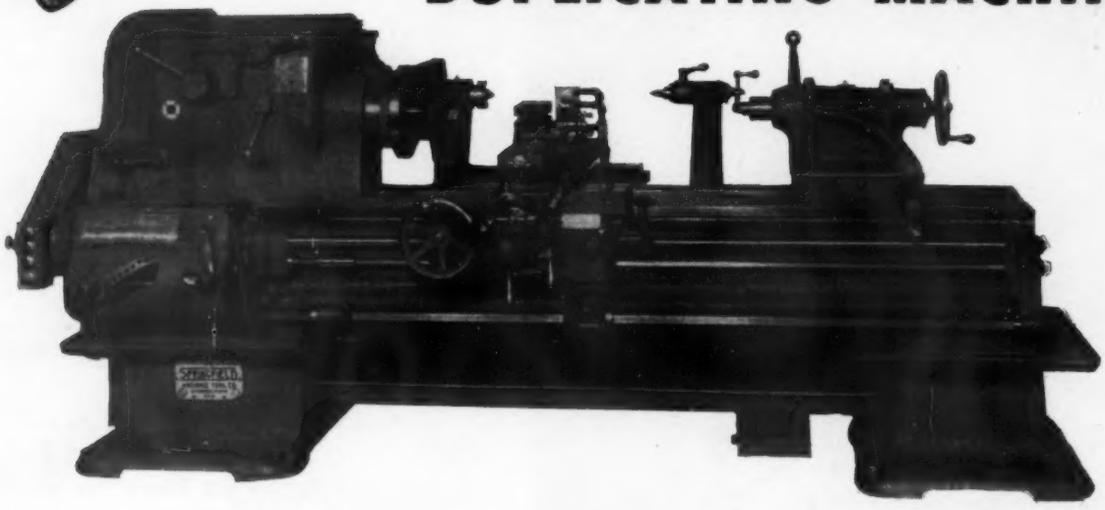
Such an automatic control system not only means that dimensions are easily duplicated but also that no head of a Bullard Cut Master Vertical Turret Lathe ever over-runs the cut or bumps any other head. Other reasons why Cut Masters are the surest means of *cutting time* on and between cuts are covered in Bulletin CVTL-4-1-46. Write for it today. The Bullard Co., Bridgeport 2, Connecticut.

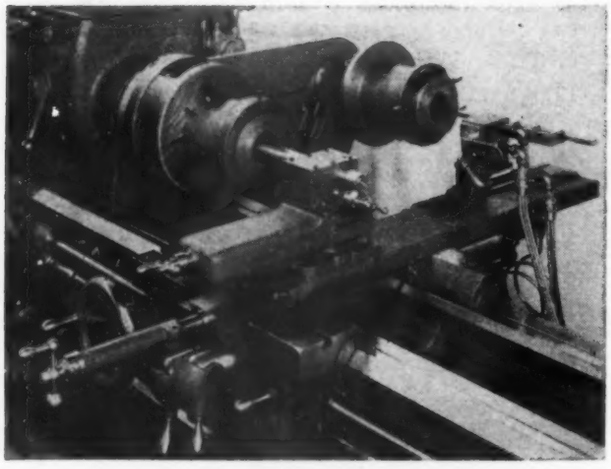


Bullard Cut Master Vertical Turret Lathes are available in 30" and 36" sizes with two heads... in 42", 54", 64" and 74" sizes with two or three heads.

CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

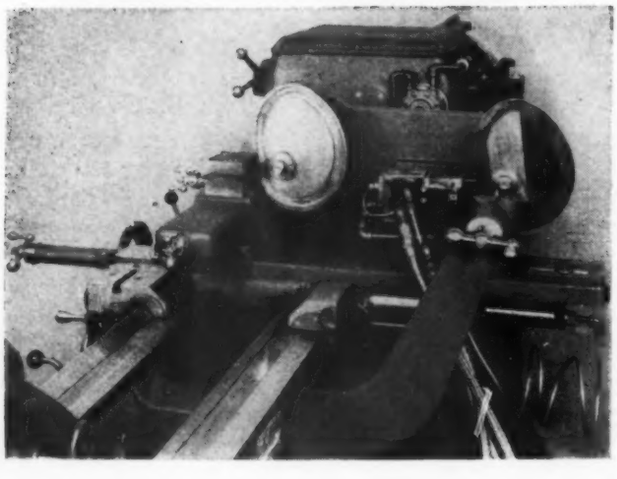
New SPRINGFIELD PROFILING AND DUPLICATING MACHINE





... reproduces many complicated forms

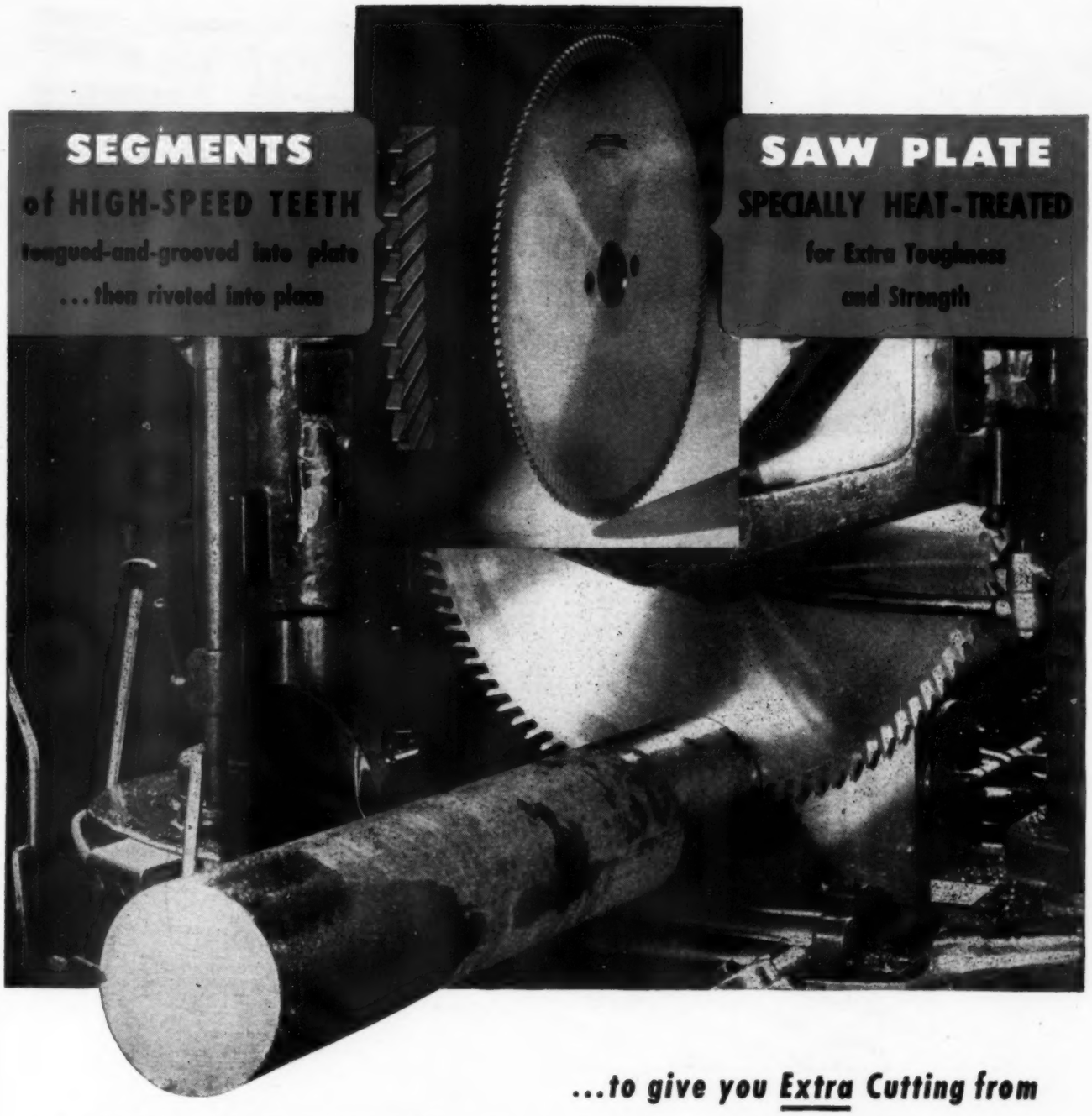
At left, the Springfield Profiling Machine in operation, reproducing a bottle mold. A master cylinder, located underneath and controlled by a stylus valve, guides the tool in proper contour. Any type of templet may be used. Templets requiring rotation are driven by an adjustable chain drive from the spindle. Twelve spindle speeds are available and speeds may be further reduced with a two-speed motor.



... from cams to bottle molds, interior, exterior

At left, producing a contour—cam. Note that only a thin metal pattern is needed. The hydraulic pump unit, including oil tank, motor, pump, relief valve and pressure gage is separate and may be located conveniently. Work requiring operations parallel or across the machine can be handled with surprising accuracy. Operators have a clear view of the work and can easily convert to engine lathe by adjustment of two screws.

SPRINGFIELD
MACHINE TOOL COMPANY
SPRINGFIELD OHIO



This fine-tooth saw delivers maximum cutting-life on work requiring a fine pitch or specially smooth cut. Double-lap construction, with teeth-segments secured *and aligned* in place by 5 rivets, gives greatest tension and torsion strength . . . and makes the saw run true, *without vibratin or chatter*, under the highest cutting pressure. Special tooth-design channels the coolant right to the cutting edge, so that dulling from friction-heating is long deferred. And even when teeth do dull, the segments are quickly and easily replaced. Order Simonds Segmental Saws from your Industrial Supply Distributor, or get in touch with the nearest Simonds office, listed at the right.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S.W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Washington. *Canadian Factory*: 595 St. Remi St., Montreal 30.

...to give you Extra Cutting from

SIMONDS

SEGMENTAL Metal-Cutting Saws

SIMONDS SAW AND STEEL CO.

FITCHBURG, MASS.

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SIMONDS STEEL MILLS — SIMONDS SAW AND STEEL CO., LOCKPORT, N.Y. — *Special Electric Furnace Steels*

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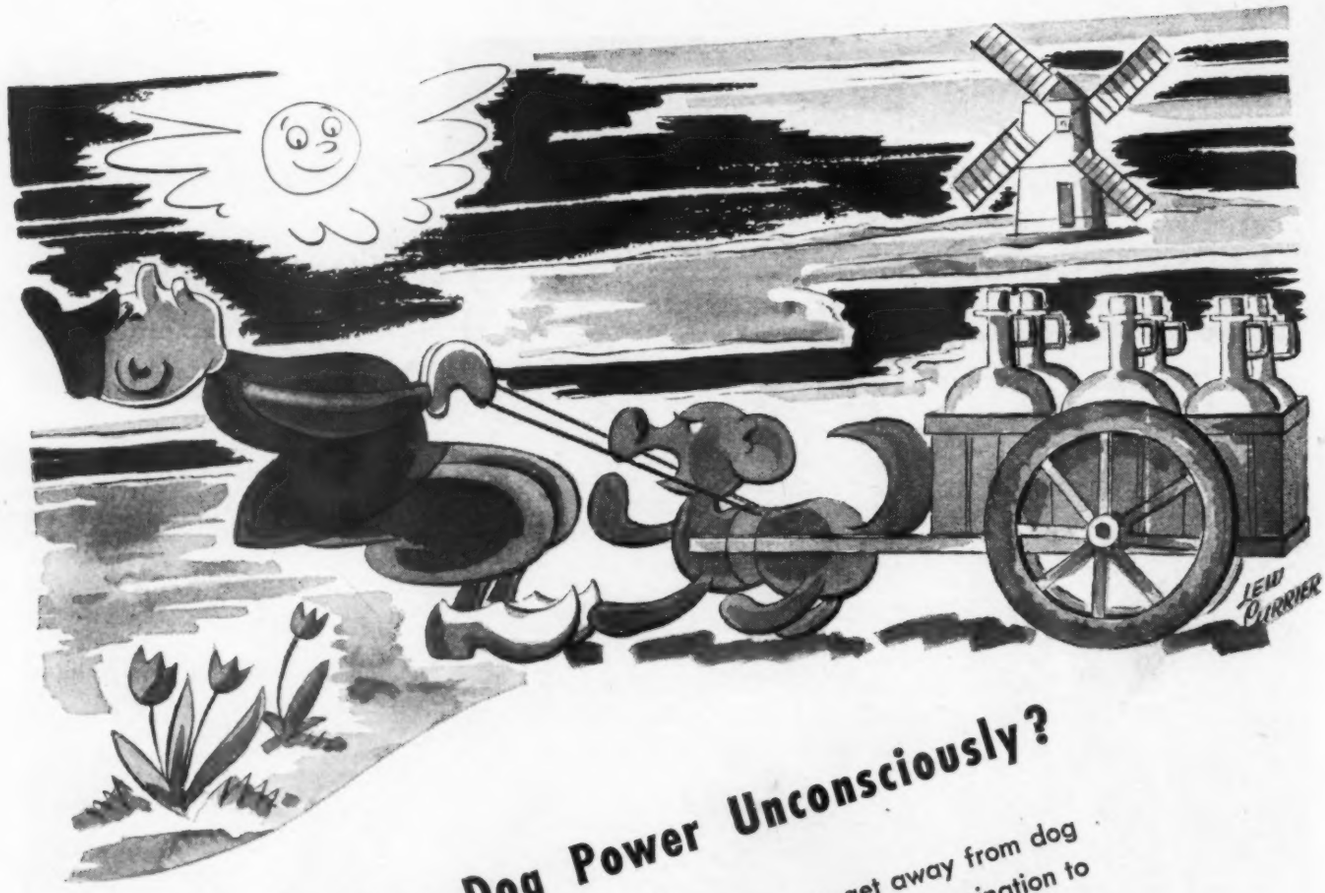
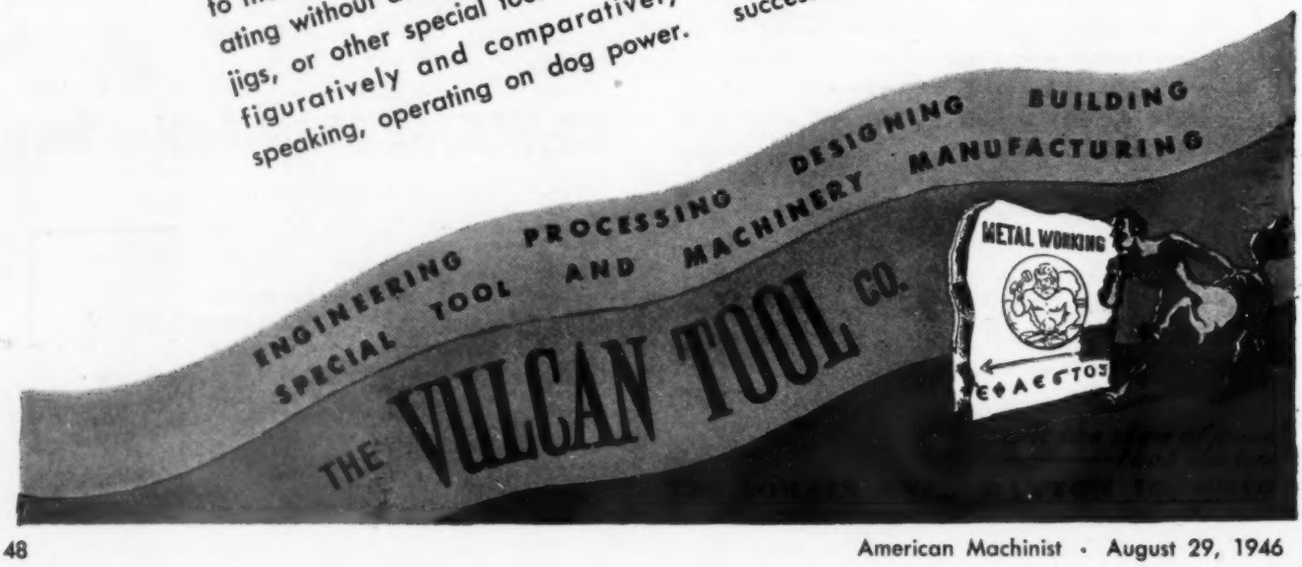
SIMONDS CANADA SAW CO. LTD., MONTREAL, TORONTO, VANCOUVER, SAINT JOHN, N.B. — *Simonds Products for Canada*



Are You Using Dog Power Unconsciously?

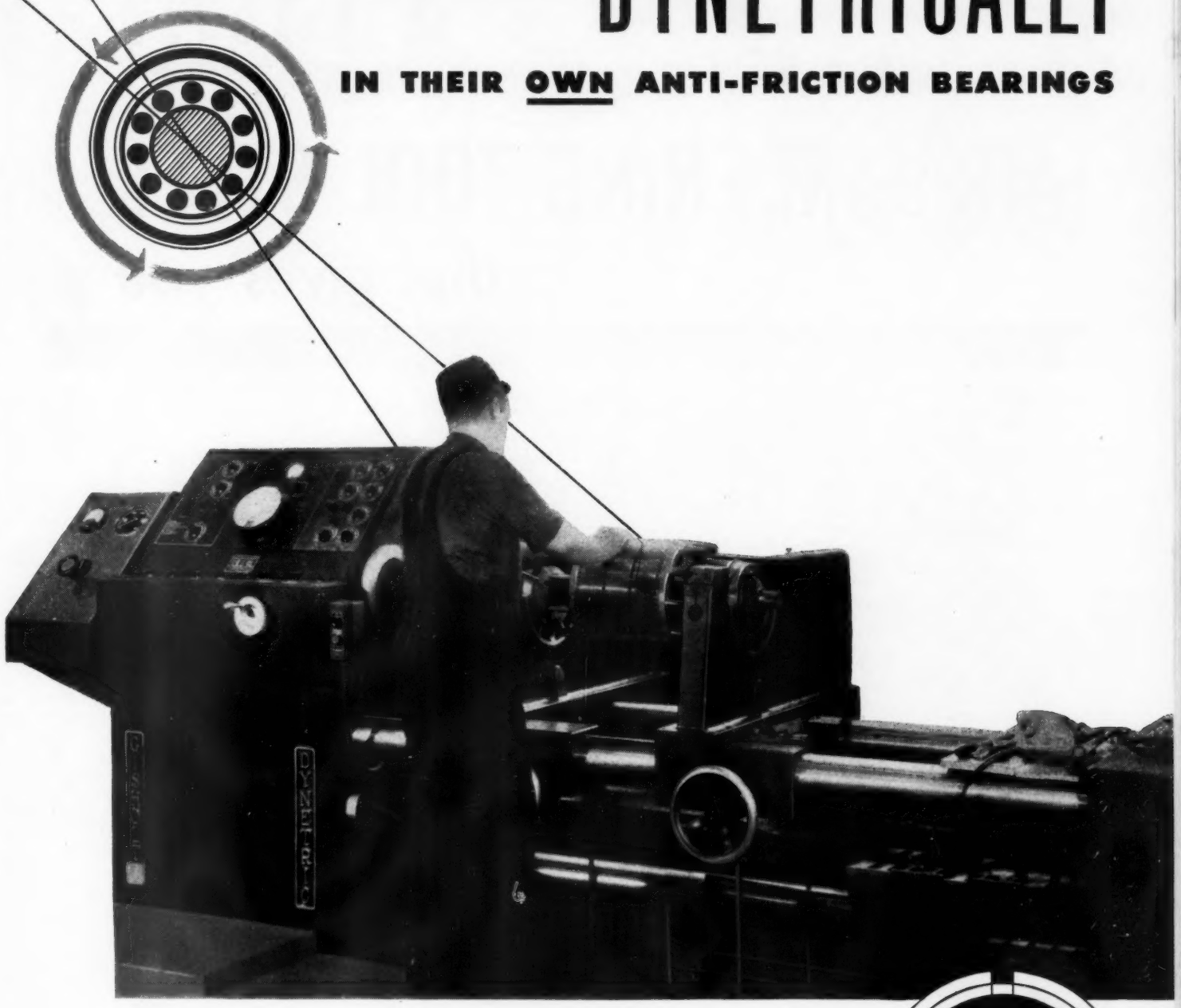
Hollanders have long used dog power to save manpower. Give them credit for getting more use out of dogs than we do, but a demerit for lagging behind you in better means of saving manpower. But are we perfect? Let us not blind ourselves to the fact that a machine tool operating without adequate special dies, jigs, or other special tools is often, figuratively and comparatively speaking, operating on dog power.

The only way to get away from dog power is to apply our imagination to each operation that is costing many man hours, and ask again and again, "Can we not build a special tool to do the job?" It might help to call in men of imagination whose whole reason for existence is to build man-power saving tools, and who have justified confidence by a record of successes.



BALANCING ARMATURES DYNETRICALLY*

IN THEIR OWN ANTI-FRICTION BEARINGS



● Here's a manufacturer who goes another step to eliminate vibration—by balancing these armatures for large induction motors in the same anti-friction bearings that will be used in the final assembly.

Armatures come to the balancing machine complete with cartridges which surround the anti-friction bearings. These cartridges support the assembly during the balancing operation, thus eliminating all unbalance due to bearing run-out. A more perfect motor is produced. Vibration is reduced to a new minimum. More dependable operation and longer life are assured.

This is another example of the way that the Dynetric principle can be used in solving any problem of static and dynamic balancing in the simplest, most practical way.

If you have to balance rotating parts—whether they weigh a fraction of an ounce or many tons—there is a size and type of Gisholt Dynetric Balancing Machine which will do it more quickly and more accurately than is possible by any other means. Write for complete information.

*Developed jointly with the Westinghouse Electric Corporation

GISHOLT MACHINE COMPANY

1221 E. Washington Ave. • Madison 3, Wis.

GISHOLT

Look Ahead . . .
Keep Ahead . . .
With Gisholt

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

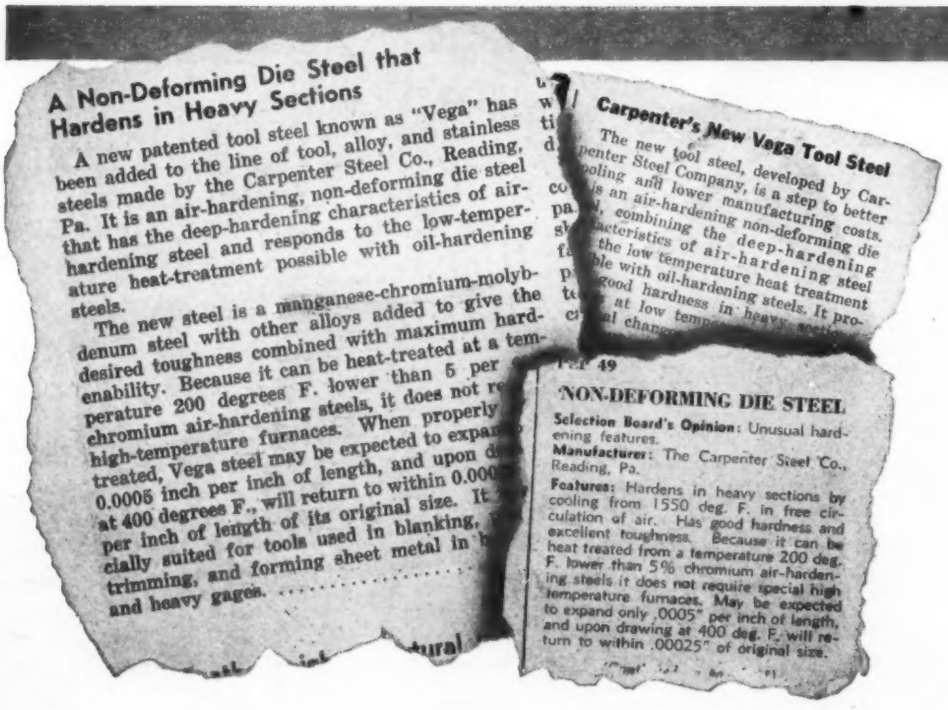
here is the NEW

VEGA

U. S. Pat. 2,355,224

AIR-HARDENING TOOL STEEL

that gives you



A Non-Deforming Die Steel that Hardens in Heavy Sections

A new patented tool steel known as "Vega" has been added to the line of tool, alloy, and stainless steels made by the Carpenter Steel Co., Reading, Pa. It is an air-hardening, non-deforming die steel that has the deep-hardening characteristics of air-hardening steel and responds to the low-temperature heat-treatment possible with oil-hardening steels.

The new steel is a manganese-chromium-molybdenum steel with other alloys added to give the desired toughness combined with maximum hardenability. Because it can be heat-treated at a temperature 200 degrees F. lower than 5 per chromium air-hardening steels, it does not re high-temperature furnaces. When properly treated, Vega steel may be expected to expan 0.0005 inch per inch of length, and upon d at 400 degrees F., will return to within 0.000 per inch of length of its original size. It cially suited for tools used in blanking, trimming, and forming sheet metal in and heavy gages.

Carpenter's New Vega Tool Steel

The new tool steel, developed by Carpenter Steel Company, is a step to better cooling and lower manufacturing costs. is an air-hardening non-deforming die combining the deep-hardening acteristics of air-hardening steel the low temperature heat treatment ble with oil-hardening steels. It pro- good hardness in heavy

Page 49

NON-DEFORMING DIE STEEL

Selection Board's Opinion: Unusual hardening features.

Manufacturer: The Carpenter Steel Co., Reading, Pa.

Features: Hardens in heavy sections by cooling from 1550 deg. F. in free circulation of air. Has good hardness and excellent toughness. Because it can be heat treated from a temperature 200 deg. F. lower than 5% chromium air-hardening steels it does not require special high temperature furnaces. May be expected to expand only .0005" per inch of length, and upon drawing at 400 deg. F. will return to within .00025" of original size.

This folder contains complete information on VEGA—its properties, heat treatment and use. To put VEGA's new advantages to work in your tool room ask for the new VEGA folder. Just drop us a note on your company letterhead, indicating your title.

Carpenter AIR-HARDENING TOOL STEELS

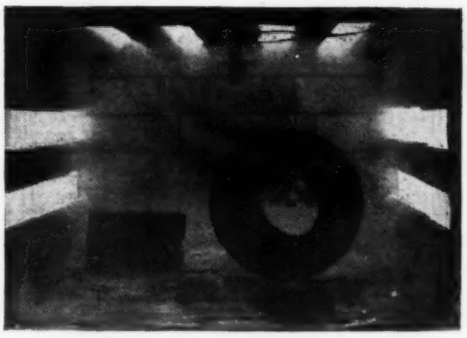
100% ACID-DISC INSPECTED

Branches at: Buffalo • Chicago • Cincinnati • Cleveland • Dayton • Detroit • Hartford • Indianapolis • New York • Philadelphia • Providence • St. Louis

EASY, LOW TEMPERATURE HEAT TREATMENT

1

The fact that VEGA can be heat treated from a temperature 200° F lower than the 5% chromium air-hardening steels often eliminates the need for expensive pack hardening to avoid excessive scaling. And because the hardening temperature for VEGA is only 1550° F, no special high temperature furnaces are required. These two advantages alone enable VEGA to do more than "pay its way" in your tool room.

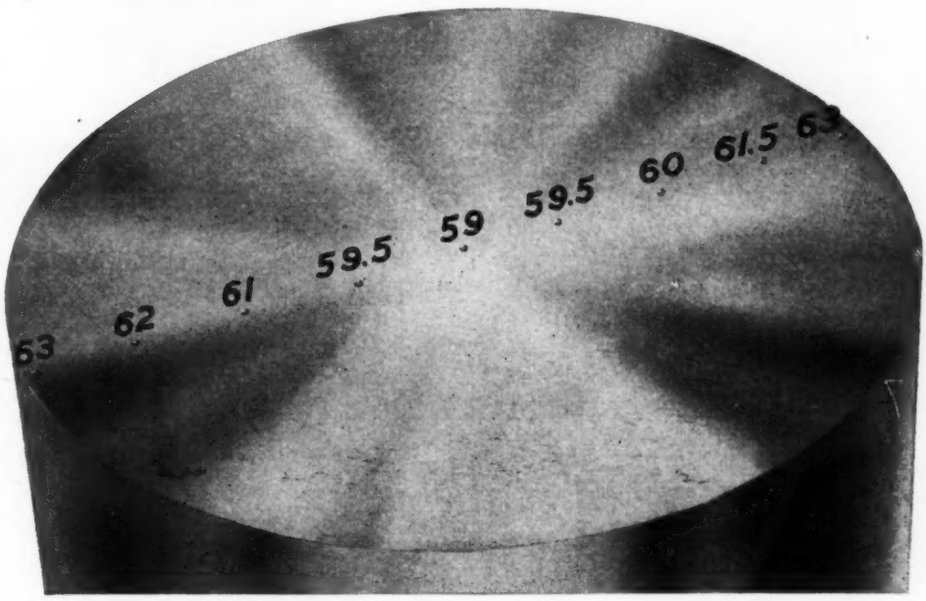


UNIFORM HARDENING IN VERY HEAVY SECTIONS

2

This new steel combines the deep-hardening characteristics of air-hardening steels with the simplicity of *low temperature* heat treatment. Notice the uniformity of Rockwell hardness values from surface to center of this 8" VEGA round. On your jobs such as blanking, piercing, trimming and forming sheet metal in light and heavy gauges—jobs where minimum distortion and size change, uniform hardening in very heavy sections are required—VEGA gives you long tool life, low production costs.

Inside Rockwell "C" Hardness of Section Cut Midway on 8" Round x 15" Long VEGA. Air Cooled at 1550°F 1 Hour at Heat.

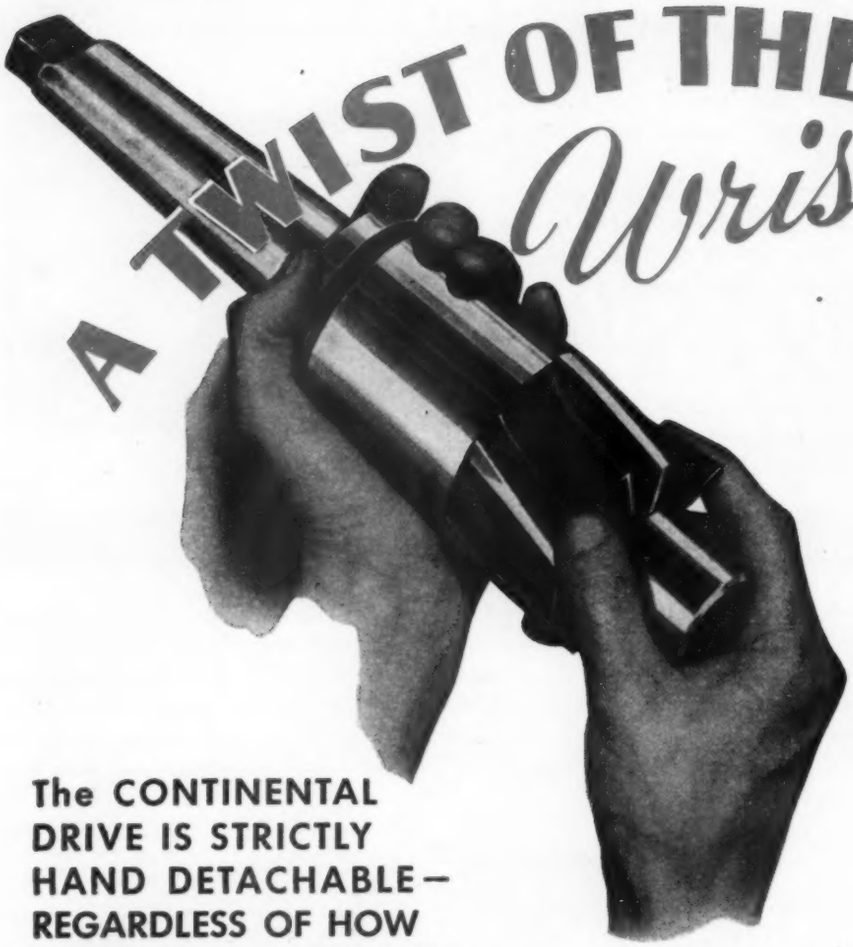


CHECK THESE EXTRA ADVANTAGES YOU GET WITH VEGA

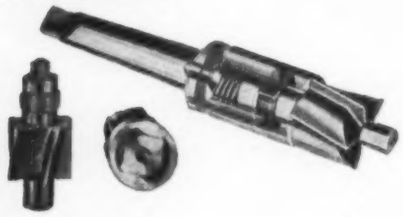
- ✓ *Minimum Distortion and Size Change*
- ✓ *Resistance to Decarburization*
- ✓ *Freedom from Excessive Scale in Hardening*
- ✓ *Good Machinability*
- ✓ *High Degree of Toughness with Good Hardness to Resist Shock and Wear*

THE CARPENTER STEEL COMPANY, 109 W. Bern St., Reading, Pa.

A TWIST OF THE *Wrist*



The CONTINENTAL DRIVE IS STRICTLY HAND DETACHABLE— REGARDLESS OF HOW SEVERE THE OPERATION HAS BEEN



With an ever-widening range of practical uses, the Continental Counterbore is proving a favorite standard cutting tool in all types and sizes of machine shops. Of rigid and simple construction, with patented features, it has long been outstanding in American industry. There's a reason: Note in illustration at left the Continental indestructible drive. It is composed of two driving lugs formed on the cutter shank, with two corresponding abutments on the inside of the holder. There is an aligning bearing above and below the driving lugs that brings the cutter and holder concentric, and prevents the cutter from being forced out of alignment. The cutter and holder are engaged and disengaged by revolving the cutter a quarter turn *by hand.* No tools or equipment are necessary.

CONTINENTAL TOOL WORKS

Division of Ex-Cell-O Corporation

DETROIT 6, MICHIGAN

CONTINENTAL TOOL WORKS

CTW

EX-CELL-O CORPORATION

Continental

CUTTING TOOLS

- Boring Bars and Tools
- Broaches
- Broach Pullers
- Broaching Fixtures
- Core Drills
- Counterbores and Countersinks
- CTW Drive Holders
- Counterbores (Tool Room Sets)
- Counterbore Pilots
- Inserted Blade Cutters
- Carbide Tipped Cutters
- Form Relieved Cutters
- Milling Cutters
- Thread Milling Cutters
- End Mills
- Side Mills
- High Speed Steel Reamers
- Carbide Tipped Reamers
- Shell Reamers
- Inverted Spotfacers
- High Speed Steel Tool Bits
- Carbide Tipped Tool Bits
- Circular Form Tools
- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

We certainly don't expect you to join our growing list of customers *unless* we can give you better abrasive products for *your particular production jobs* . . . plus better service.

Our rapid growth in ten years from one of the smallest makers of abrasive products to one of the largest, didn't just happen. Company after company found we could help them get better production, lower costs . . . and give them better service. That's how we built our business.

Should you use MID-WEST abrasives? The only way we know for finding out is for you to give us a trial. It's worth it . . . if you're looking for better production, lower costs, and better service. Call us. We'll cooperate.

James Jackson
PRESIDENT

MID-WEST ABRASIVE COMPANY

OWOSSO, MICH. DETROIT ROCHESTER, PA.

GRINDING WHEELS HONING STONES COATED ABRASIVES

ARMSTRONG

Drop Forged

EYE BOLTS

They'll carry the load

Specify ARMSTRONG Drop Forged EYE BOLTS for extra strength—correctly engineered proportions, forged-in quality, uniformity of design in all sizes, and the best mild steel, heat treated to increase tensile strength.

ARMSTRONG Drop Forged EYE BOLTS as built to tool standards, are not hammered out in "tonnage forgings". They come in plain or shoulder patterns, blank or threaded, in 14 sizes, shank diameter from ¼" to 1½", inside diameter of eye ¾" to 2½". They will always carry their rated load safely.

Write for Catalog

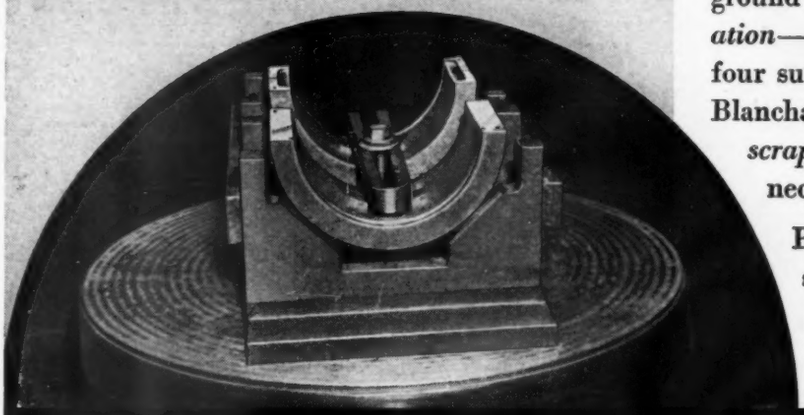
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. Francisco Ave. Chicago 12, U. S. A.

Eastern Whse. and Sales: 199 Lafayette St., New York 12, N. Y. Pacific Coast Whse. and Sales Office: 1275 Mission St., San Francisco 3, Calif.

"Put it on the Blanchard"



GRINDING HALVES of TURBINE BEARING

Material: steel and bearing babbit

Size (assembled): 12⅞" O.D., 9⅛" I.D., 7⅝" LG.

Held in an inexpensive fixture on the magnetic chuck of a No. 18 Blanchard Surface Grinder, *both halves* of the turbine bearing are finish-ground at the parting joint *in the same operation*—1/64" is removed from each of the four surfaces. The flatness and finish of the Blanchard-ground surfaces are such that *no scraping* or other means of correction is necessary to provide *oil-tight joints.*

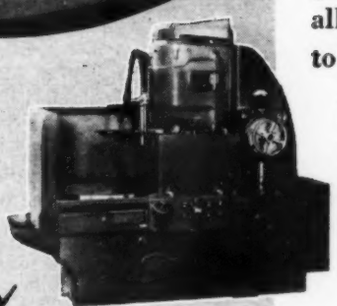
Production is 4 pairs or 8 halves (16 surfaces) per hour. This includes loading and unloading the pieces in the fixture.

The bearing halves are then assembled and held together in a simple clamping fixture. Returned to the Blanchard—*no machine changes are necessary*—both ends of the assembled turbine bearing are finish-ground. (1/64" is removed from each end.) The Blanchard-ground end surfaces are *flat and parallel,* allowing the subsequent finish-boring operation to be registered from either of them.

Production is 8 half bearings (16 surfaces) per hour, which includes assembly and clamping time.

Get These Advantages...

PRODUCTION ✓
ADAPTABILITY ✓
FIXTURE SAVING
OPERATION SAVING ✓
MATERIAL SAVING
CLOSE LIMITS
FINE FINISH ✓
FLATNESS ✓



Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

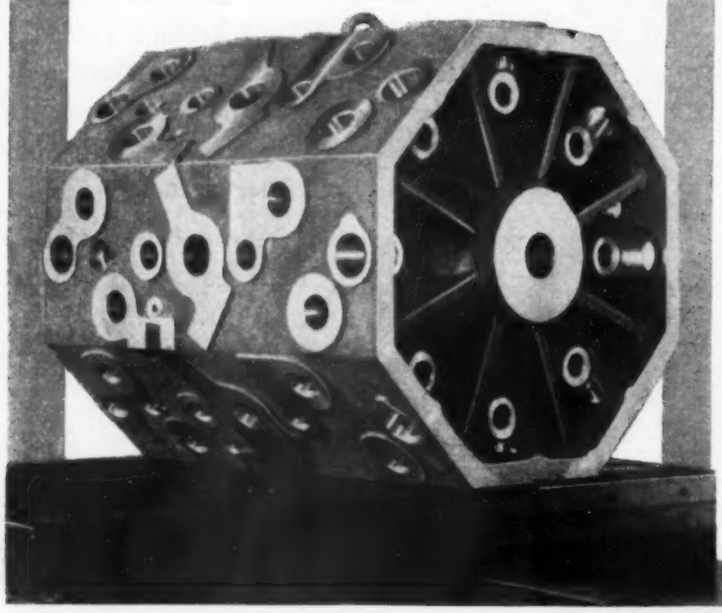
They're Building a Business around JIGMIL Performance!

JACK CUNNINGHAM
and MATT JACKSON
Founders of Zip Tool and
Engineering Company

The World's
Finest Jig Boring
and Milling Machine!

140 Holes—8 Faces, 2 Ends—Milled and Bored Complete to Overall Accuracy within .0005"! Floor-to-Floor Time: 75 Hours!

Typical JIGMIL work being done by Zip Tool and Engineering Company of Detroit is the large trunnion shown below. Made for a special precision index milling and drilling machine, its eight faces and two ends have a combined total of 140 holes! The entire job, milled and bored complete to overall accuracies within .0005", was done on the JIGMIL by means of push button controls! Total floor-to-floor time: 75 hours!



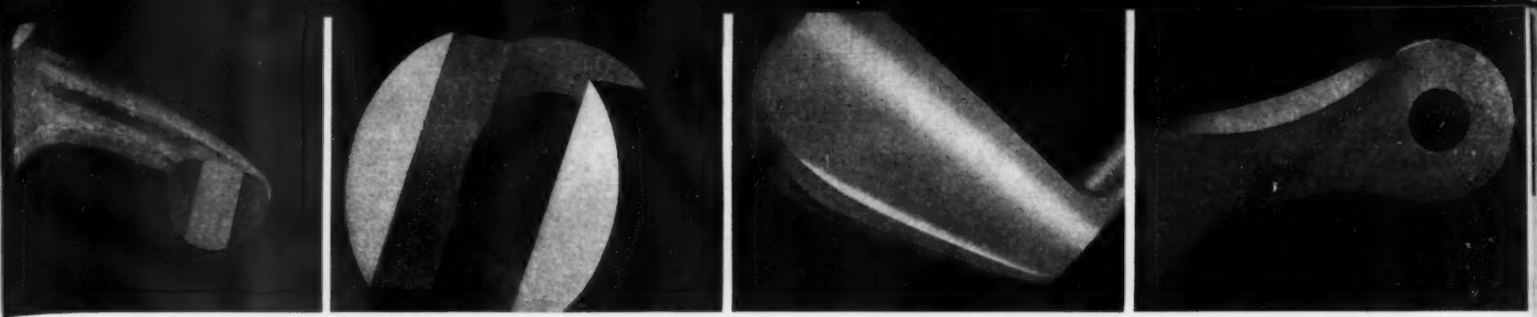
Recipe for a Business!

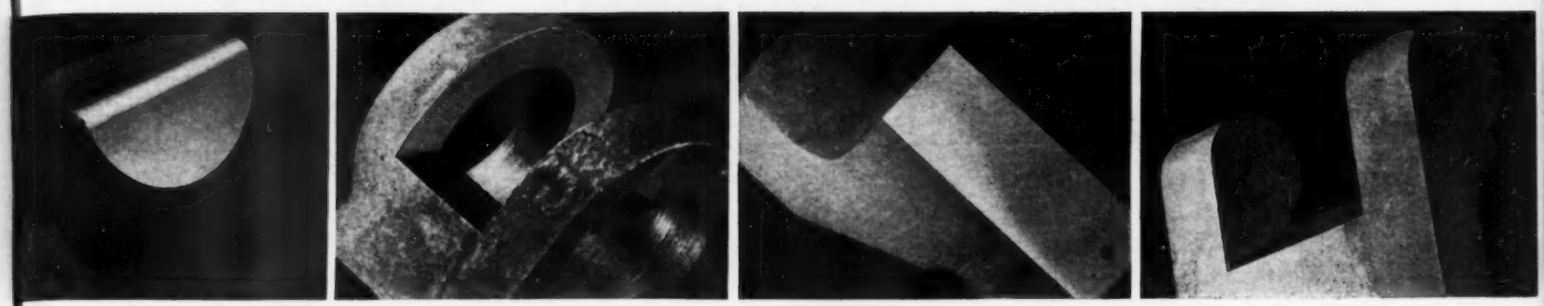
Take two skilled, enterprising mechanics, add one DeVlieg JIGMIL, and you have the essential ingredients required to start a good tool and machine business. That's the formula followed by Jack Cunningham and Matt Jackson in launching their own Zip Tool and Engineering Company in Detroit.

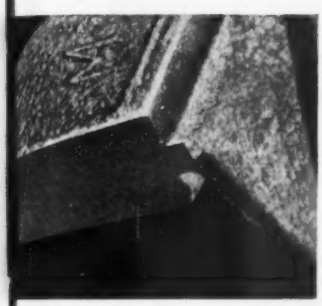
Both were tool-makers with JIGMIL experience; both saw the possibilities of building a business around JIGMIL performance. Pooling their assets, they managed the JIGMIL down payment, arranged for financing, then went to work. Now they're on the way toward needing a second JIGMIL in preparation for broadening their activities into a full functioning tool and machine business.

Technical literature describing 3-B DeVlieg JIGMIL design, construction and operation is available upon request. Write for your copy today!

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**



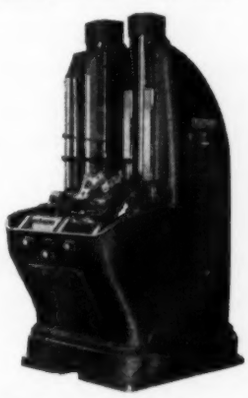




the advanced machining method

★ Wherever metal is removed on duplicate small parts you are apt to find a place where Footburt Surface Broaching Machines can cut Manufacturing costs. Production is high, parts can be machined to very close tolerances and tool maintenance is low in cost per piece. We have had many years of experience in designing the tooling for various types of parts and will gladly advise you in applying surface broaching to your work.

THE FOOTE-BURT COMPANY
CLEVELAND 8, OHIO
Detroit Office: General Motors Building



Duplex Surface Broaching Machine
. . . also Single Slide Machine

Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*

EVERY DEMAND FOR SAVINGS IS BEING MET . . .

. . . in *"The Tools You Buy Again"*

Small tools — at the business ends of machines working to capacity — must be capable of making time, labor and material savings in order that production demands be met. UNION TOOLS are meeting such demands in the countless plants turning out war materiel. They are saving time by faster cutting — saving labor by requiring less resharpening — conserving material by assuring accuracy and minimizing spoilage.

The ability of UNION TOOLS to make savings is traceable to an in-built fineness of quality which in turn is the result of UNION'S long, specialized experience in small tool development.

For the sake of savings, it will pay you to standardize on UNION.

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws — End Mills — Taps — Dies — Screw Plates — Profile Cutters.

•

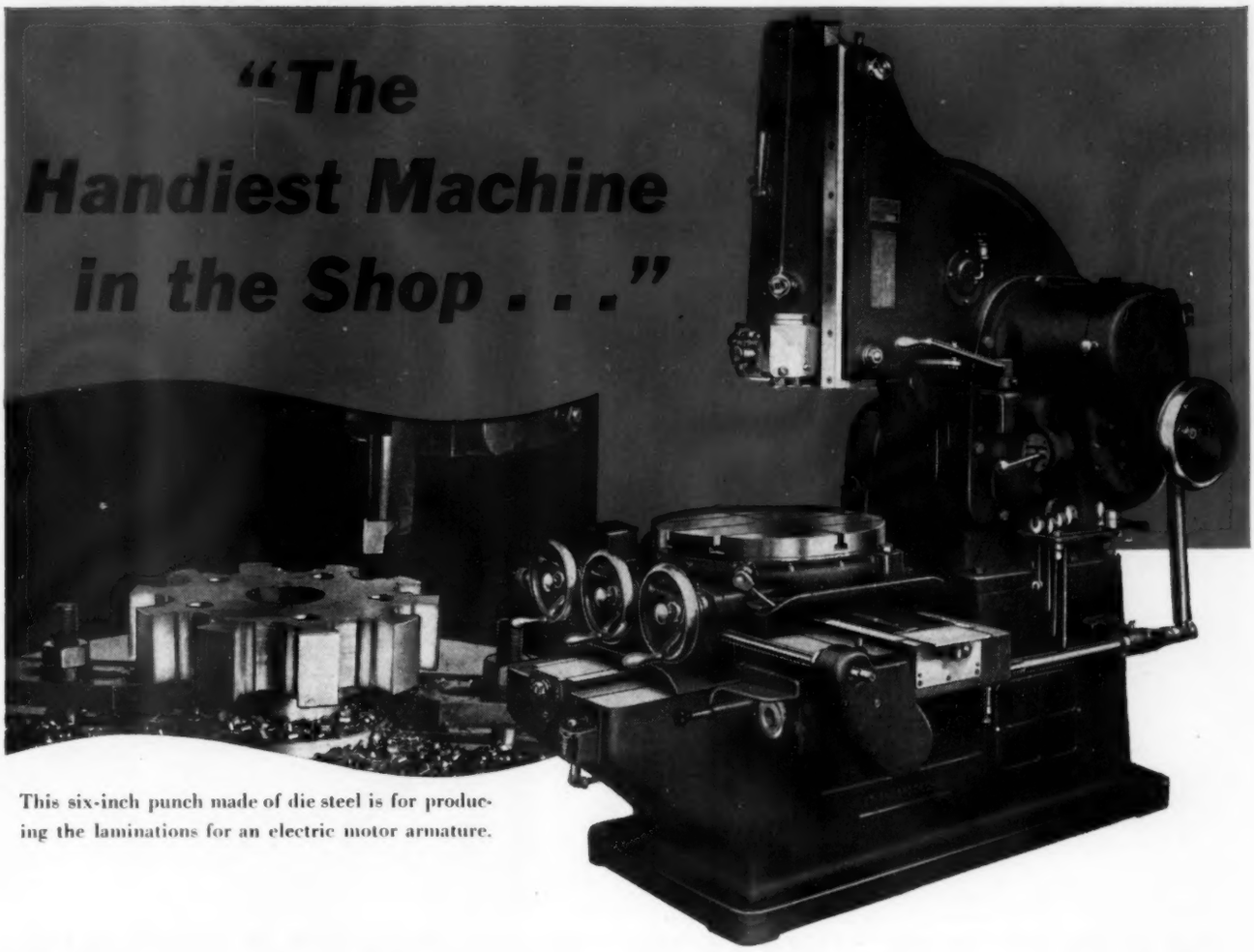
UNION
TWIST DRILL COMPANY
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 5527 Woodward Ave.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec

UNION

"The Handiest Machine in the Shop . . ."



This six-inch punch made of die steel is for producing the laminations for an electric motor armature.

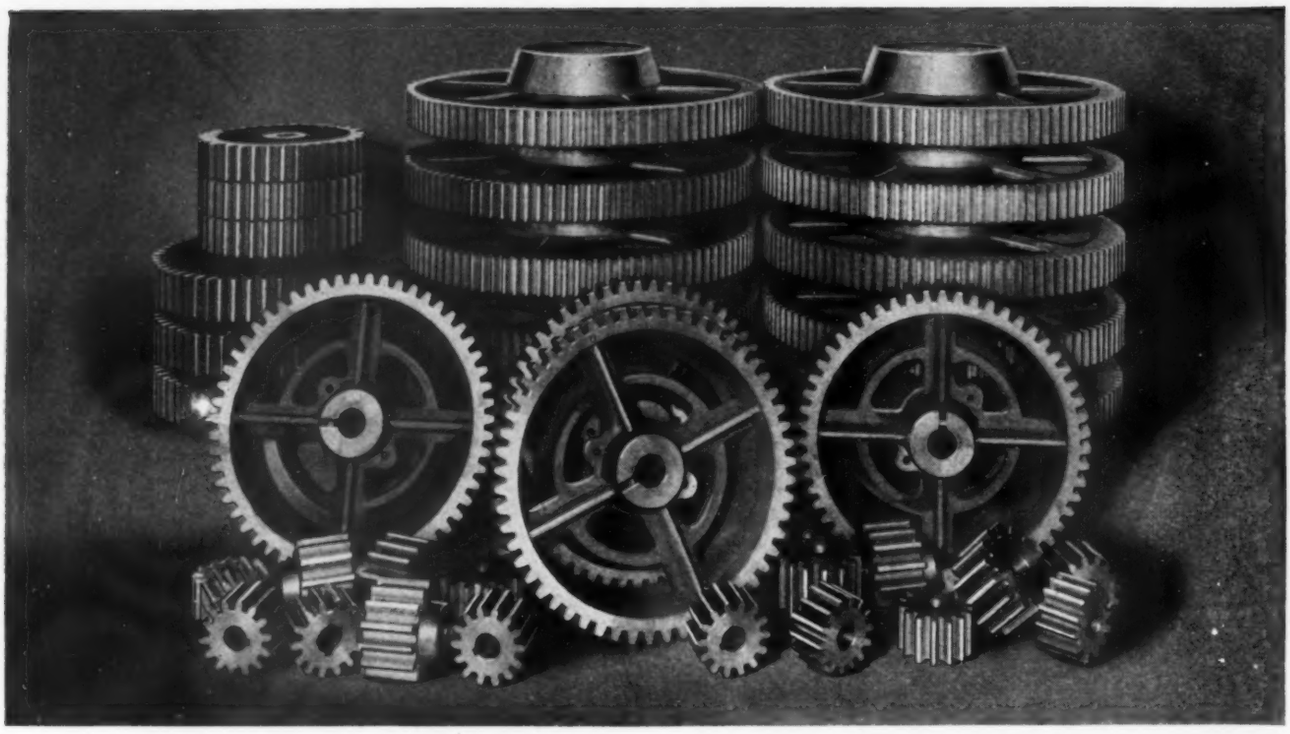
Cutting irregularly shaped work is on the daily schedule of most every tool shop. One of the handiest machines to do this work is the Pratt & Whitney Vertical Shaper. On this machine any good machinist can finish these special jobs quickly and accurately, often without a single time-killing change in setup. Its vertical construction makes possible three outstanding features: increased strength assuring permanent accuracy; hand and power rotary feeds to the table; and better observation of work progress.

The model shown is the P&W 12-inch Vertical Shaper with a ram stroke of 0 to 12". There is also a 6-inch model with a ram stroke of 0 to 6". Recognized as a sound investment, P&W Vertical Shapers are in tool rooms everywhere. Write on your company letterhead for further information.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT



GEARS

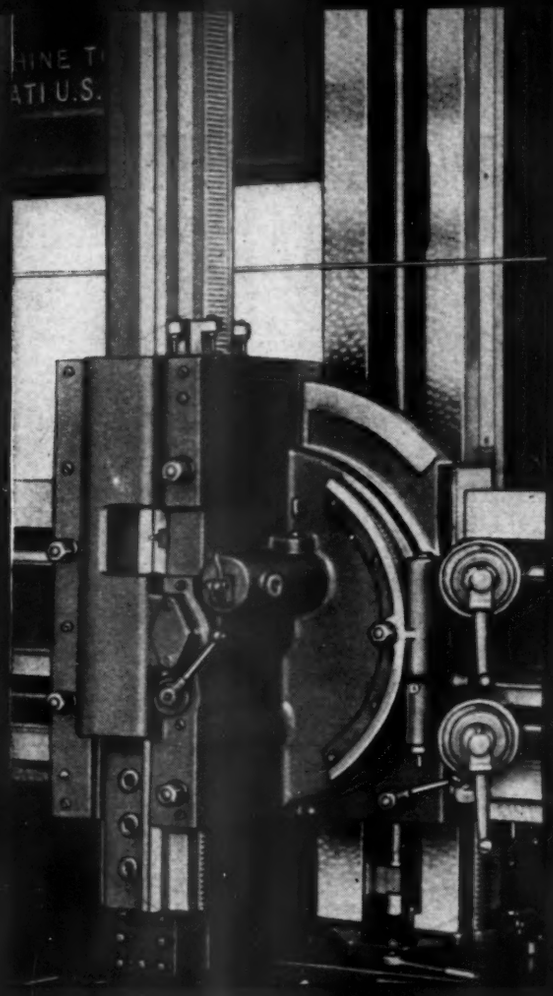
MADE TO YOUR SPECIFICATIONS

Before you buy stock Gears find out the benefits to you through the purchase of Gears made specifically for your requirements.

Our experienced gear experts will be glad to confer with you relative to your gear problem.

SPUR GEARS
HELICAL GEARS
BEVEL GEARS
MITRE GEARS
INTERNAL GEARS
WORMS
WORM GEARS
SPROCKETS
RATCHETS
SPLINED SHAFTS
RACKS
SEGMENT GEARS
LEAD and FEED SCREWS

The **ADAMS COMPANY**
DUBUQUE, IOWA
ESTABLISHED 1883



Massive Rams & Ram Heads Ideal for Carbide Tools

● One of the main advantages of the new series King Vertical Boring and Turning Machine are the new, rectangular type rams of massive proportions and extreme accuracy. Exceptionally powerful and rigid, they will take the heaviest cuts at the highest speeds which modern carbide tools will withstand.

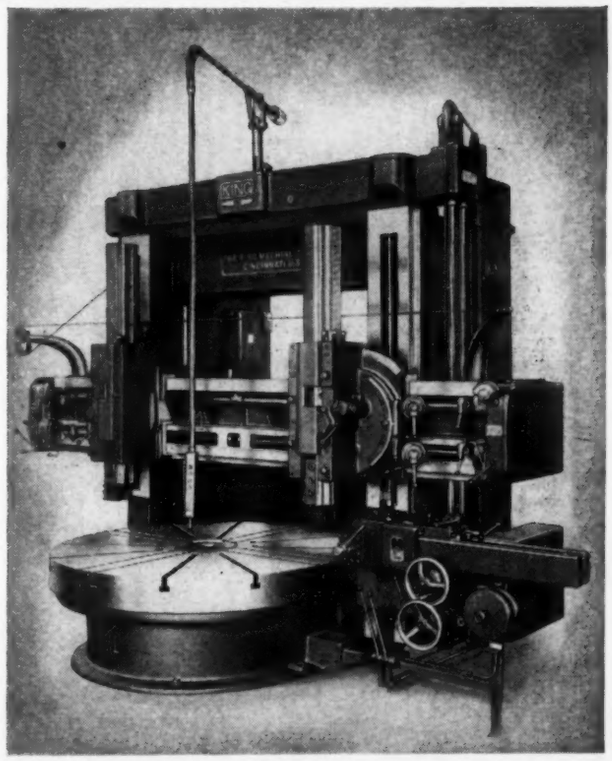
The saddle for the ram is square locked and fitted with four tapered gibs for adjustment. A heavy tie plate across the swivel provides added rigidity.

Consult King on your Boring, Turning Facing and similar operations.

KING

VERTICAL BORING & TURNING MACHINES

Available in ten sizes: Single Column 30", 36", 42". Double Column 52", 62", 72", 84", 100", 120", 144".



THE KING MACHINE TOOL COMPANY

CINCINNATI 29, OHIO

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

SNYDER SPECIAL CENTER DRIVE MACHINE FOR DOUBLE END TURNING OF SHAFTS

Newest development of a well-proven special-purpose machine design is this center drive, double end turning machine with front and rear tool slides.

Work part shown is an automotive axle shaft on which production is 90 to 100 cycles an hour at 80% efficiency, using tungsten carbide tools throughout. Any similar type shaft can be processed on this type machine with comparable efficiency.

Tailstock center is retractable to permit easy manual loading and is brought in hydraulically by a manually operated hydraulic valve. The part is held between centers without deflection and is gripped by three serrated jaws in the center drive. After loading, the center drive is manually engaged through a clutch lever on the headstock and the part is rotated.

On starting the work cycle, front tools move into position and travel along the work, turning various diameters and forming a taper on one end while the rear tools likewise move in and perform facing, chamfering and undercutting operations.

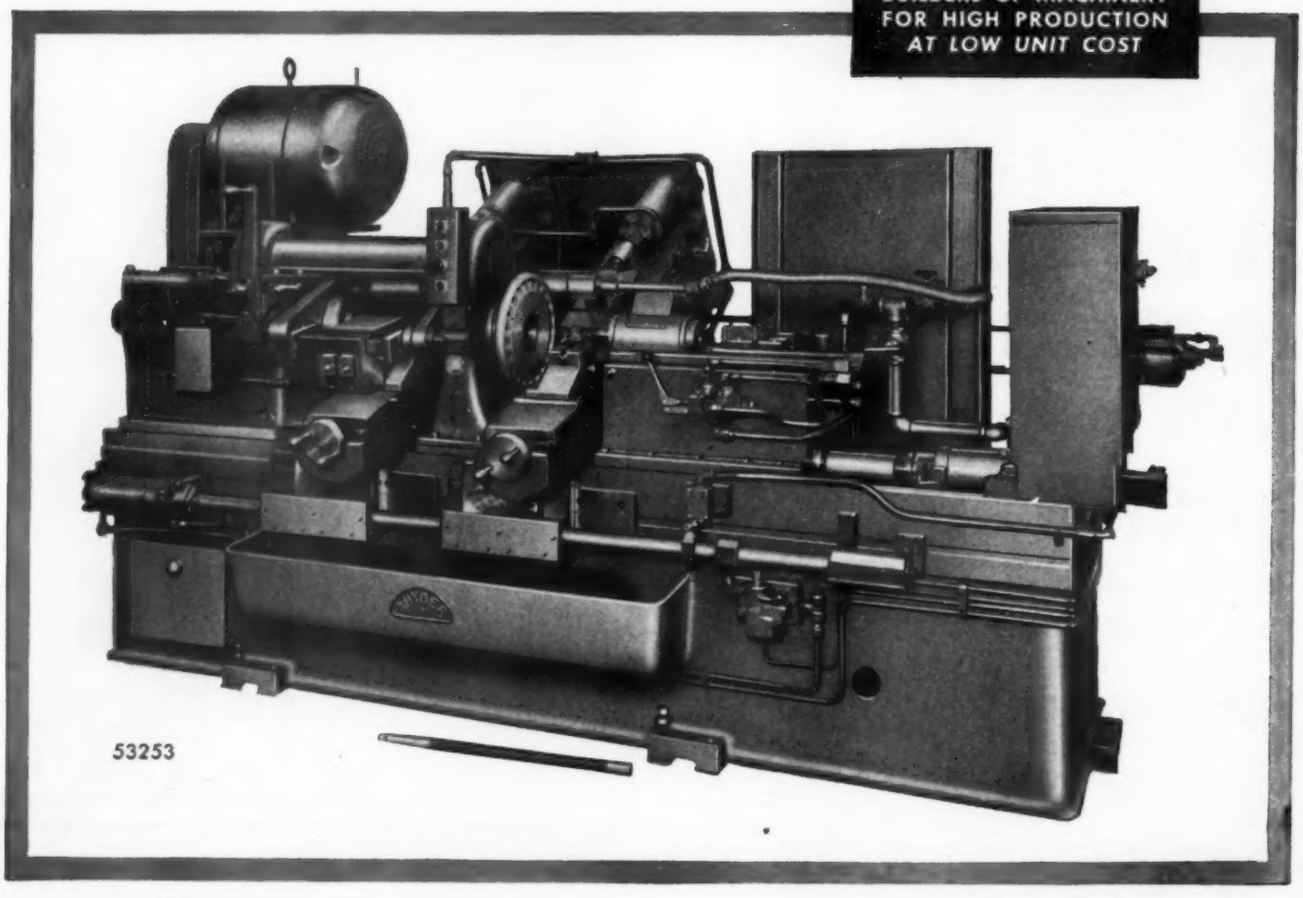
When turning is completed to limits ready for heat treating and finish grinding, tools retract from the work and then return to starting position, thus avoiding spiral tool marks on the work.

Four motors provide operating power, one for headstock and rotation of work, two for hydraulic equipment, one for the coolant pump. Base is welded steel and houses coolant trough and chip pan.

This versatile unit can be adapted to a wide range of related turning applications and offers opportunities for notable economies in production costs. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette Ave., Detroit 7, Michigan.*

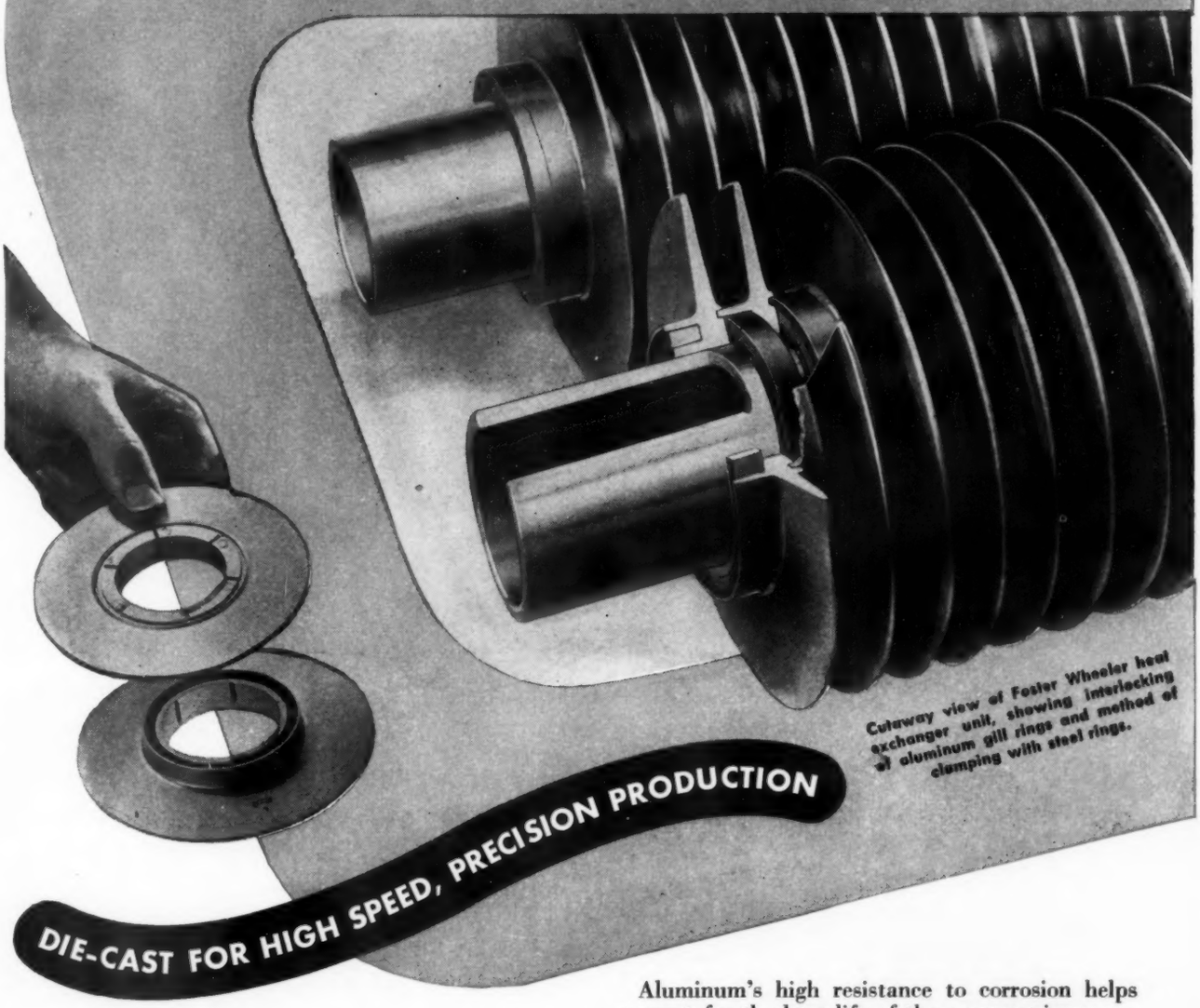
21 Years of Successful Cooperation with Leading American Industries

SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST



Gill rings of Alcoa Aluminum

FOR RAPID HEAT TRANSFER AND LONG LIFE



Cutaway view of Foster Wheeler heat exchanger unit, showing interlocking of aluminum gill rings and method of clamping with steel rings.

DIE-CAST FOR HIGH SPEED, PRECISION PRODUCTION

Foster Wheeler Corporation uses Alcoa Aluminum gill rings on its economizer tubes to reduce weight and space. The reduction in space is due to two characteristics of aluminum—the ability to provide more surface per foot and the higher rate of heat transfer. (An economizer recovers heat which would otherwise be wasted up the stack, and uses it to raise the temperature of boiler feedwater.) Aluminum's high heat conductivity speeds the transfer of heat into the water.

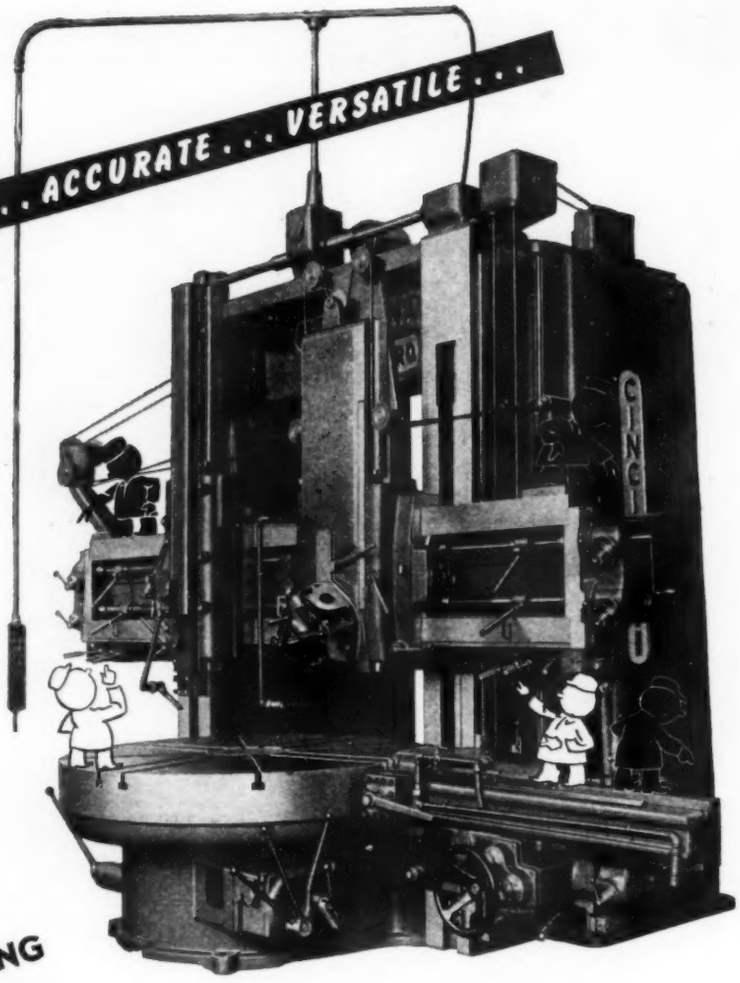
Aluminum's high resistance to corrosion helps account for the long life of these economizers.

Die-cast by Alcoa, these gill rings, as received by Foster Wheeler, need no finishing to prepare them for assembly. Alcoa Aluminum die castings have close dimensional tolerances and smooth surfaces.

Whether you've a problem of heat transfer or a need for die castings, we are ready to serve you. Call the nearby Alcoa office, or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

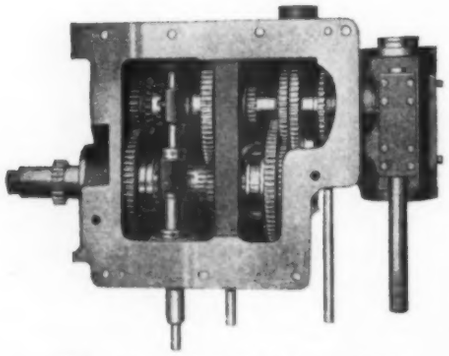
ALCOA FIRST IN **ALUMINUM**

IT'S FAST . . . ACCURATE . . . VERSATILE . . .



The NEW and IMPROVED CINCINNATI HYPRO Boring Mill

FEATURING INDEPENDENT FEED, RAPID TRAVERSE AND REVERSING MECHANISM FOR EACH HEAD



Hypro Anti-Friction Power Feed and Traverse Box

An individual unit is provided for each Head and contains the complete power feed, rapid traverse, reversing mechanism and safety clutches.

All levers for feed, traverse and reverse are placed in front of the machine convenient to operator's working position.

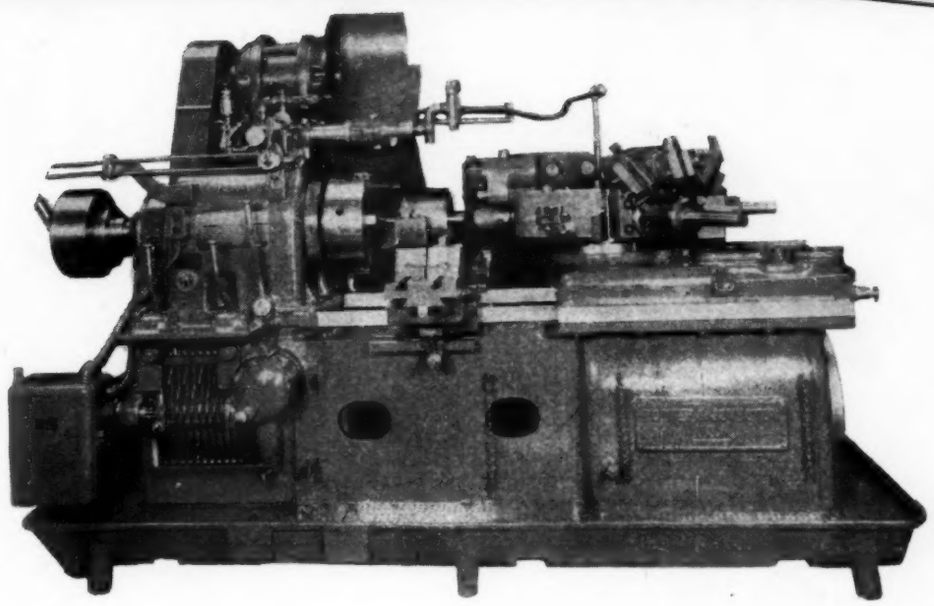
Each box contains hardened alloy steel gearing mounted on multiple splined shafts and anti-friction bearings. Complete unit is enclosed and runs in a bath of oil supplied by a pump incorporated in the box.

THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

The P&J 5D POWERFLEX



Specifications

Swing over bed—25"
Swing over cross slide—12"
Travel of cross slide—5" each way
Number of turret faces—5 std. 4 and 6 special
Diameter of hole in turret—2½"
Turret feed—8"

Combining

great Flexibility . . . and high productive capacity on chucking work

Long specialized experience has been applied by P&J in the development of this automatic chucking machine for the economical production of duplicate parts. Its features are modern and it employs unit construction throughout. It is amply powered, of great rigidity and can be depended on for maximum production at minimum cost per piece.

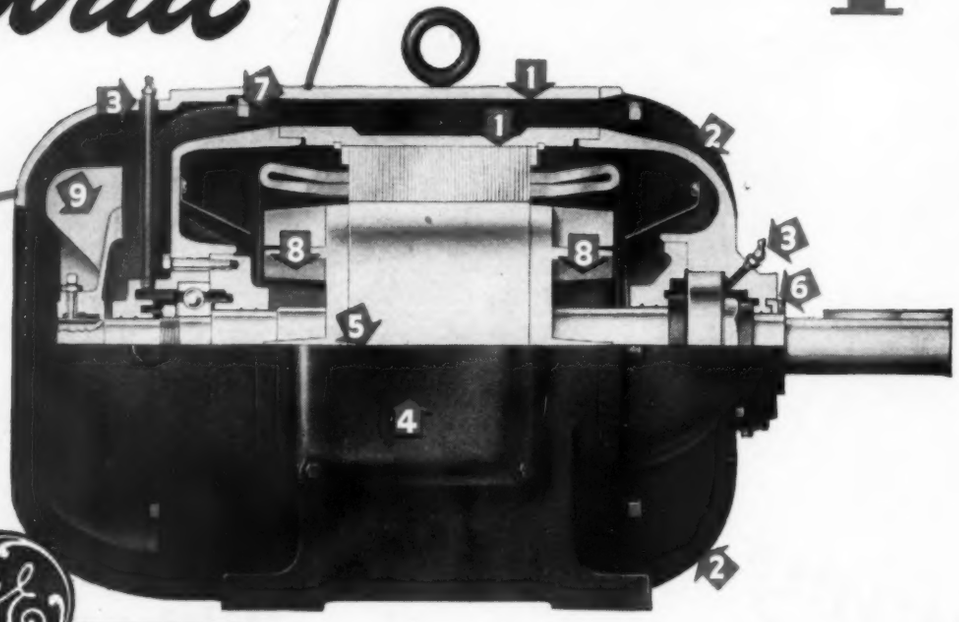
The 5D Powerflex provides four automatic changes of spindle speed while under cut as well as three selective automatic changes of feed, automatic binding of turret following index, powerful, direct cross slide action and a constant high speed motion to the cross slide and turret slide.

Accuracy, speed and low maintenance together with outstanding convenience in handling are among the many advantages assured by this modern chucking machine.

Send for Bulletin 122 describing the 5D Powerflex in detail.

POTTER & JOHNSTON MACHINE COMPANY
PAWTUCKET, RHODE ISLAND

A Double Wall Keeps



TRI CLAD

TOTALLY ENCLOSED STANDARD and EXPLOSION-PROOF MOTORS

These 9 points of new strength and serviceability put this TRI CLAD totally enclosed motor way ahead.

1. A cast-iron, double-wall frame that completely encloses windings and punchings
2. Ribbed, cast-iron end shields, machined to provide a tight seal, yet easily removed
3. Well-proved, pressure-relief greasing system which can be packed with a long-life lubricant where advisable
4. Cast-iron conduit box diagonally split for wiring convenience (independently explosion-proof on explosion-proof motors)
5. Leads are sealed in a nonshrinking compound at the point where they emerge from the frame
6. Rotating labyrinth seal prevents infiltration of grit or liquids
7. Large, free-flowing, easy-to-clean air passages protect parts from accumulation of dust and foreign material
8. Modern "ageless" insulation treatment includes Formex* magnet wire
9. Powerful external fan is removable, simplifying maintenance (nonsparking type for explosion-proof motors)

AND IN ADDITION—compactness and short length promote ease of handling and installation

*Trade-mark reg. U.S. Pat. Off.

FOR THE COMPLETE STORY

Apparatus Department
General Electric Company
Schenectady 5, N. Y.

Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motor.

Please send me GEA-4131, "Motors and Control for Hazardous Locations."

Name .....

Company .....

Address .....

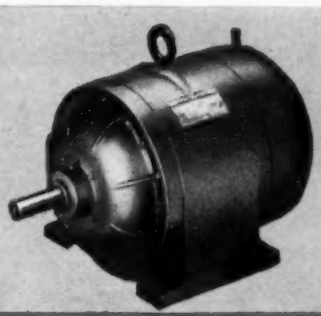
750-257-8030

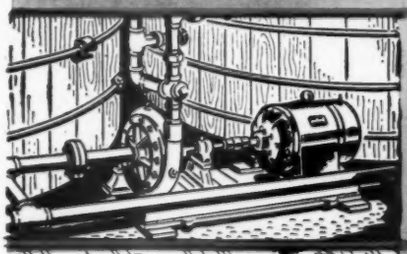
GENERAL ELECTRIC

Trouble Out

NEW TRI/CLAD TOTALLY ENCLOSED MOTOR IS MORE FULLY PROTECTED FROM DUST, DIRT, WEATHER, OR WHAT HAVE YOU...

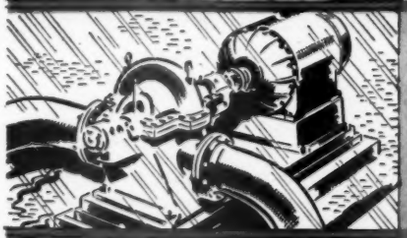
Now, General Electric has applied Tri-Clad construction to its line of totally enclosed induction motors (1 to 1000 hp) and to most of its explosion-proof motors as well. *Extra protection* has been raised another notch.





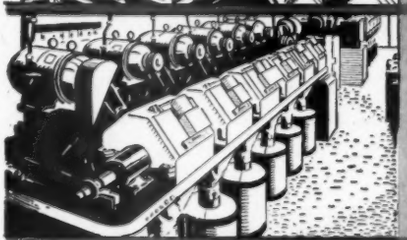
FOR EXTRA-SEVERE JOBS

Applications amid dust, metal filings, coolants, or corrosive agents—where totally enclosed motors have always been required—will now have the benefit of a stronger armor, plus convenience features that simplify installation and servicing.



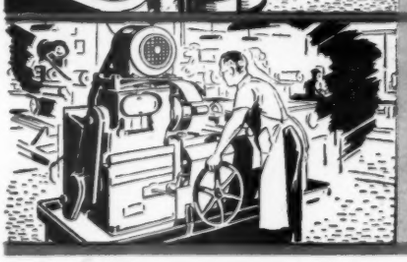
FOR EXTRA-WET LOCATIONS

Indoors or out, these Tri-Clad totally enclosed motors will take hosings or heavy rains without danger of shutdown. The cast-iron frame is strongly resistant to rust and corrosion.



FOR HAZARDOUS ATMOSPHERES

"Companion motors" to the standard Tri-Clad totally enclosed, the new explosion-proof and dust-explosion-proof types are tested and listed by Underwriters' Laboratories for Class I, Groups C and D, and Class II, Groups E, F, and G.



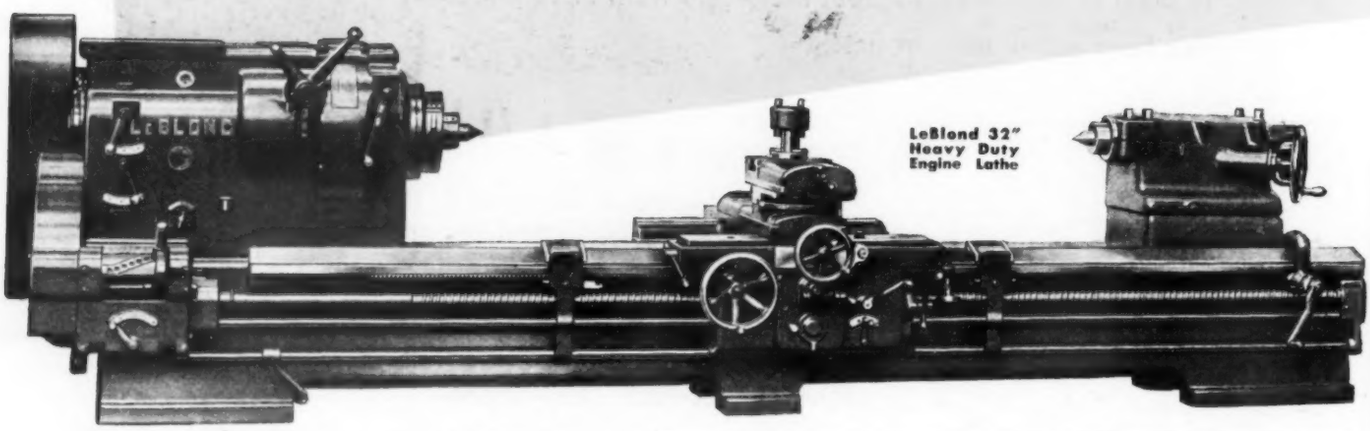
FOR EXTRA-LONG LIFE

Many motor users are making the totally enclosed motor their standard for *all* jobs—based on evidence of long-term savings. This new member of the Tri-Clad line makes this decision more logical than ever.

BIRMINGHAM

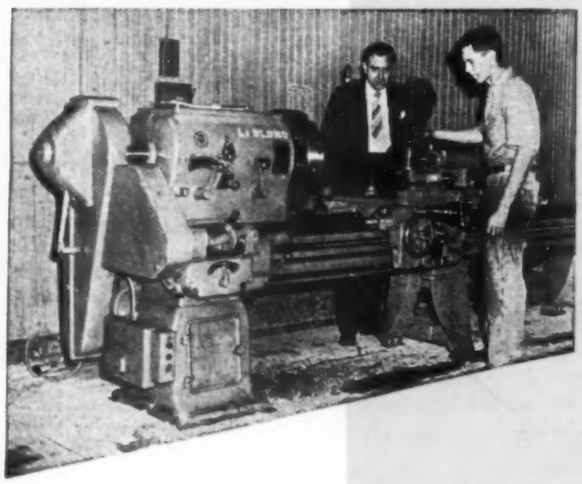
J. M. BATES,
Moore-Handley Hardware Co.,
Birmingham 2, Ala.

"In the South's big industry town, we do big work with big tools. This job at the BIRMINGHAM MACHINE DIVISION, Jackson Industries, Incorporated, Birmingham 6, Ala., is typical. We chuck a 40,000 lb., 32 ft. Ingalls Ship propeller shaft in a 32" LeBlond Heavy Duty Engine Lathe (we figure 10,000 lbs. on the chuck). It calls for a smooth finish ¼" overall cut with 'blue fit' taper and threading at the propeller end. Tolerances are microscopic! This lathe's powerful drive and smoothness cut these operations to 40 hours, way under estimate."



LeBlond 32"
Heavy Duty
Engine Lathe

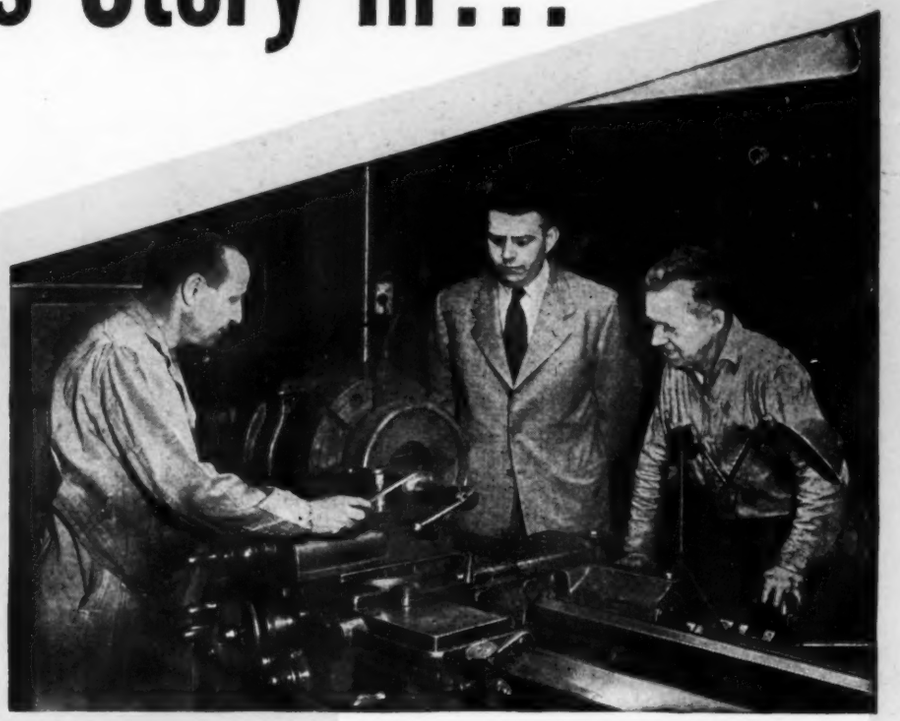
NORFOLK



"That old saw about precision always being costly doesn't necessarily apply to lathes anymore. Anyone who watches a LeBlond Regal in action will realize that. This 24" Regal in the shop of the PRECISION ENGINEERING CO., 306 E. Water St., Norfolk, Va., is handling big work and little, fast work and close work, and that word . . . Precision . . . in the Company's name is being upheld. The clutch and brake on this lathe is a fine feature too. It saves a lot of time on every job."

H. P. MOORE, JR.,
The Henry Walke Co.,
Norfolk 1, Virginia

Industry's Story in...



R. H. HEARTT,
Hoffman & Heartt,
Los Angeles 21, Cal.

LOS ANGELES

"In our phenomenal growth to a manufacturing center for the entire Coast Area, we've given flexibility a new definition. We produce a perplexing variety of goods, much of it big equipment like this example. At M. P. McCAFFREY'S plant, here at 2121 E. 25th St., in L. A., I checked one of our 20" LeBlond Heavy Duty Engine Lathes turning power shovel brake drums in a way that really kept them moving. And they've lots of other uses for that lathe. It's a big machine that does a fine manufacturing job."

These LeBlond Agents and many others . . . one of them near you . . . know metal turning as few men know it. Since they offer the largest line of lathes available from one manufacturer, their unbiased advice on the selection of a lathe for any specific use can be relied upon.

The R. K. LeBlond MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

NEW YORK 6, Singer Bldg., 149 Broadway, COrtlandt 7-6621-2-3

CHICAGO 6, 20 N. Wacker Drive, STA 5561

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

"A Modern Must" - GRAY NON-METALLIC TABLE WAYS*

Finish Planing TWO VEE AND TWO FLAT GRAY NON-METALLIC TABLE WAYS . . of a 10'x16' GRAY PLANER.

Remember

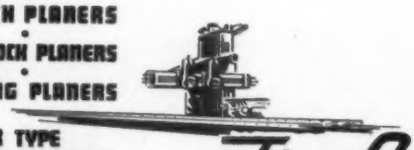
"A Machine Tool is no better than its ways. There is no adequate substitute for the GRAY NON-METALLIC WAY."

The GRAY NON-METALLIC TABLE WAY* becomes a modern "must" when you consider the work load that may be placed on a planer of this size. Don't gamble—play safe—specify GRAY NON-METALLIC TABLE WAYS.*

* Protected by Patent #2,378,343 and Pat. Pending.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS

PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES



The G.A. GRAY Co.

CINCINNATI 7, OHIO, U. S. A.

Sold in Canada by Upton, Bradeen and James Ltd. ● Sold in Latin America by Machine Affiliates.

STOCK *Paraform** SLAB MILLS...
HAVE EXTRA CUTTING STRENGTH

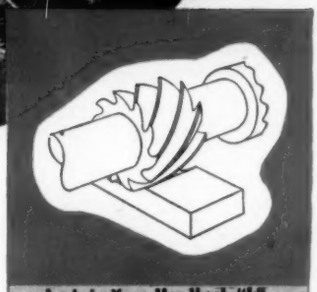
For PRODUCTION SLABBING

These are *heavy-duty* cutters for use where a considerable amount of stock is to be removed. The distinctive Barber-Colman *Paraform* tooth design, with wide tooth spacing, provides powerful backing for the cutting edges on heavy cuts . . . and gives extra chip clearance as well. Amazing performance on tough jobs is ample proof that these *standard stock cutters* have unusual capacity for metal removal. When conditions call for a heavy slabbing cut, you get EXTRA CUTTING STRENGTH when you use Standard Barber-Colman Heavy Duty Plain Milling Cutters.

An exceptional war-time achievement

Standard Barber-Colman Heavy Duty Plain Mills were used on a long profiling cut on the edges of *cast armor plate* tank hulls. Each cut was 1⅜" deep by 2½" wide and 6 feet long, and the whole cut was completed in 8 hours. Each Barber-Colman cutter produced 50 hulls. In the whole program of 5,000 hulls cutter breakage on Barber-Colman cutters was only .005%. Anyone who has worked with tough, hard armor plate will recognize that this is exceptionally good performance — and fine testimony of the quality of Barber-Colman Standard Cutting Tools.

*"Combining form" . . . the *Paraform* tooth design combines maximum tooth strength with greatest possible chip clearance.



Look in Your Handbook "L"

Page 154 gives complete listing of standard stock Heavy Duty Plain Milling Cutters, ranging from 2½" in diameter by 2" face to 4½" diameter and 12" face.

New Transparent Protecto-Coat

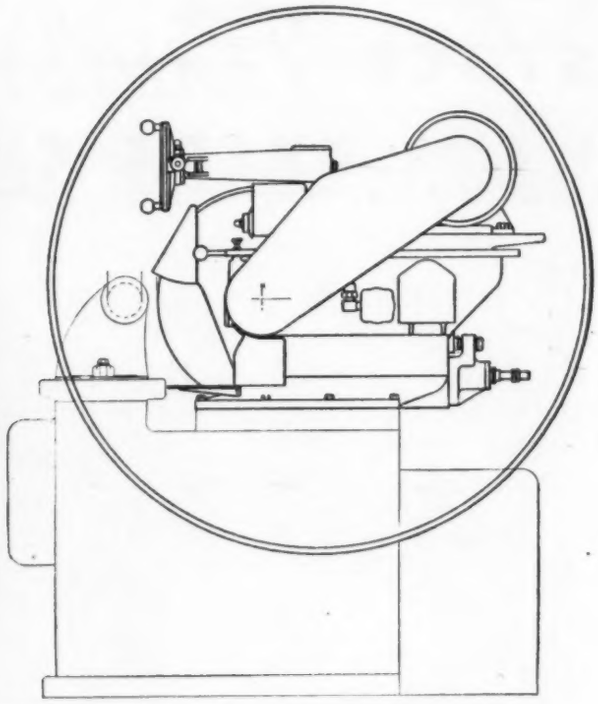
Safeguards all B-C cutting tool edges until used. Easily removed by slitting the coating and peeling it from the tool.

BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

You too can have FITCHBURG *Automatic* PRECISION GRINDING *INEXPENSIVELY...*

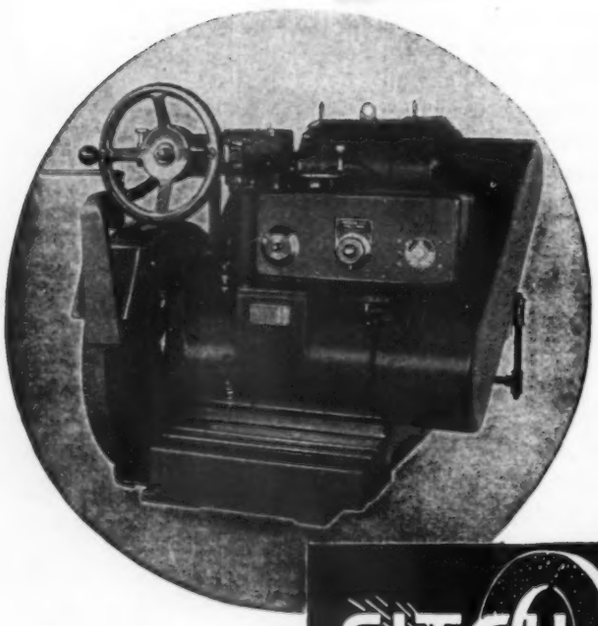


FITCHBURG Bowgage Head mounted on another make of grinding machine

...by installing FITCHBURG Bowgage Heads on the Grinders you now have.

Just as we did in the above case—and in many others—we'll be glad *to prove to your satisfaction* the ease, the simplicity, and the *inexpensiveness* of installing Fitchburg Bowgage Heads on your present grinders. With your grinding equipment thus modernized, the resulting mass production applied to your precision grinding will soon pay off the small cost involved.

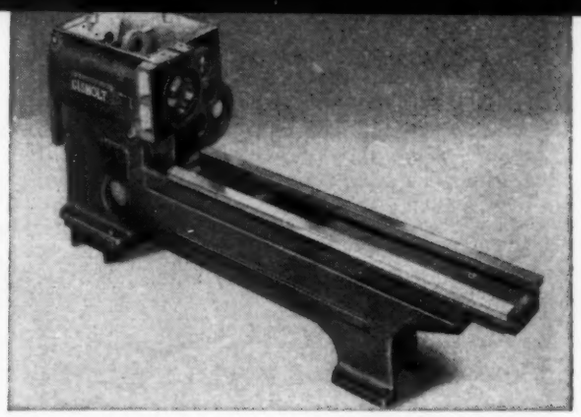
The FITCHBURG Bowgage Head is a self-contained grinding unit, with *all* its movements and controls within itself. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position—all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed—thus protecting your investment in grinding machinery. Fitchburg engineers will welcome the opportunity to help you solve your grinding modernization problem. There is, of course, no charge for this service. Send us the details—blueprints if available—and see how easily and inexpensively *you too* can have FITCHBURG AUTOMATIC PRECISION GRINDING in your shop.



FITCHBURG
BOWGAGE HEAD

FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U.S.A.
Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders

how RIGIDITY preserves ACCURACY



Above: *Bed and Headstock are cast integrally to form an extremely heavy unit and to provide the rigid foundation for all types of work.*

Below: *Solid block type ways are straddle keyed to the bed and ground in perfect alignment with the spindle. All working surfaces are hardened to 64-66 Rockwell "C".*

Here are two good reasons why you can count on the accuracy of Gisholt Turret Lathes—now and years from now.

One-piece bed and headstock, cast as a heavy, rigid unit, reduce distortion and vibration to a minimum. Headstock is jig-bored to insure—and *maintain*—perfect alignment of spindle and drive shafts, with ample metal to provide the most solid support possible.

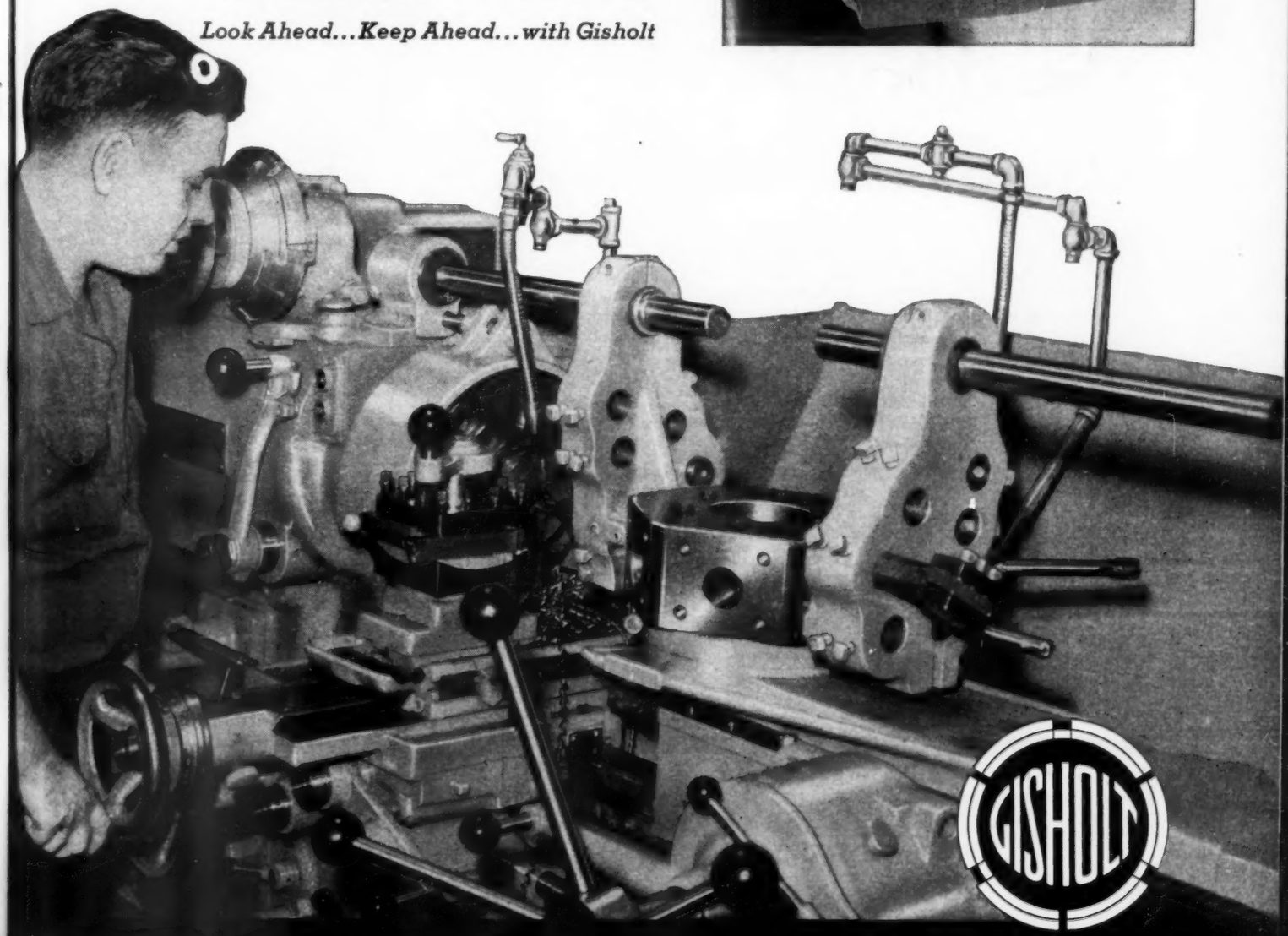
Hardened steel ways are augmented by hardened steel strips secured to the ram saddle, as well as hardened steel gibs and clamps, making an assembly that is virtually wear-proof. Its accuracy is further preserved by force lubrication.

These advantages are yours for the long life of any Gisholt Turret Lathe. Ask for complete details.

GISHOLT MACHINE COMPANY

1201 E. Washington Ave. • Madison 3, Wis.

Look Ahead...Keep Ahead...with Gisholt



TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Reg. U. S. Pat. Off.

SOCKET HEAD CAP SCREW

Yes, the knurled head of the "Unbrako" Socket Head Cap Screw makes it a time- and money-saver, because the knurls provide a slip- and fumble-proof grip, even for oily fingers. Thus it can be screwed-in faster and farther before it becomes necessary to use a wrench. Of outstandingly good quality, it is neat and attractive, too . . . helps make any machine look better.

Pat'd. & Pats. Pend.

Socket Set-Screws are furnished with 5 different styles of points. Of these the Cup-Point (left) is the only one which, when knurled, converts its screw into a Self-Locker. The knurled point digs-in and refuses to budge . . . regardless of the most chattering vibration! Yet, this screw can easily be backed-out with a wrench and used again and again. However, the "Unbrako" Socket Set Screw with Knurled Threads (right), is also a Self-Locker, regardless of the style of point. It can, therefore, be used where the "Unbrako" Cup-Pointed Self-Locker would be unsuitable.

Pat'd. & Pats. Pend.

All screws in sizes from #4 to 1½"; write for the "Unbrako" Catalog of Socket Screw products. **"Unbrako" and "Hallowell" products are sold entirely through distributors.**

Knurling of Socket Screws originated with "Unbrako" in 1934.

OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

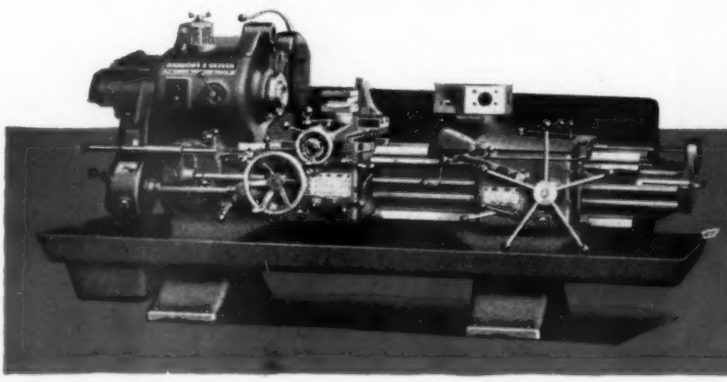
Three Cuts at One Time

REMOVE 1⅜" DEPTH OF METAL

Machining costs drop when this heavy alloy steel forging is turned on a Bardons & Oliver No. 21 Universal Turret Lathe. Three carbide cutters, two on the hexagon turret and one on the cross slide take simultaneous cuts at 150 feet per minute cutting speed with coarse feeds removing about 4-1/2 pounds of chips per minute.

Such delivery of brute power without sacrifice to life-long precision is typical of Bardons & Oliver Turret Lathes. Crowd them for years — yet they still produce accurately. Bardons & Oliver Turret Lathes take maximum advantage of the fast production possibilities in carbide cutting tools because they were designed to deliver and stand up under just such rugged requirements.

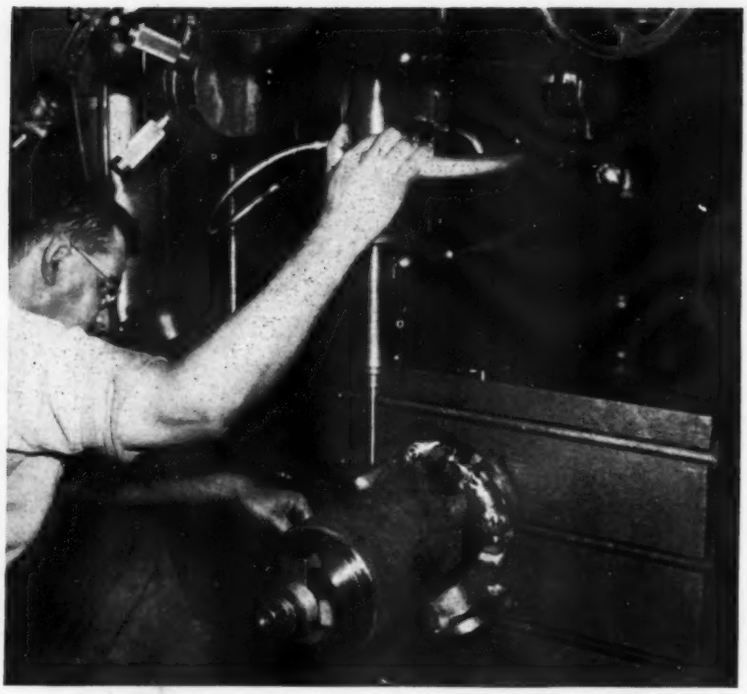
Do you have a difficult machining problem? A high cost problem? Investigate the Bardons & Oliver Turret Lathes. Send us a blue print or sample of work and let our tool engineers recommend equipment and tooling.

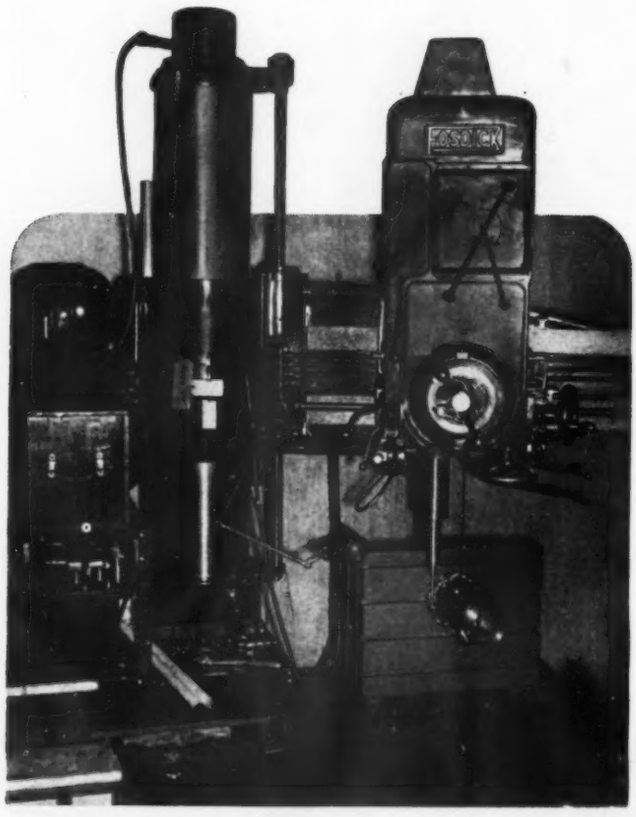


BARDONS & OLIVER, INC.

1133 WEST 9TH STREET CLEVELAND 13, OHIO

IT'S EASIER
to make
PRODUCTION QUOTAS
with
FOSDICK
Hydraulic RADIALS.





Outside of the natural flexibility of a Radial, you'll find the hydraulic control on the Fosdick makes it easier to operate—quick and positive as to control—and foolproof.

For example the hydraulic control simplifies mechanical functions and produces ease of movement. Hydraulic column clamp, operated from the head, is simple and foolproof. Interlocking lever for unclamping, raising and lowering the arm eliminates necessity for two levers and possibility of operator forgetting to clamp arm when drilling. All controls at operator's fingertips.

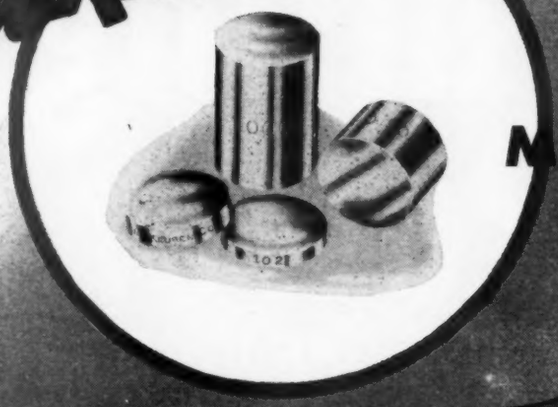
Thirty-six spindle speeds and eighteen feeds are provided on all sizes.

If you want greater production and lower costs on your radial drill work specify Fosdick Hydraulic Radial for your next job.

Complete construction and design details with specifications on all sizes are furnished in Fosdick Radial Bulletin R.D.A. *Write for yours.*

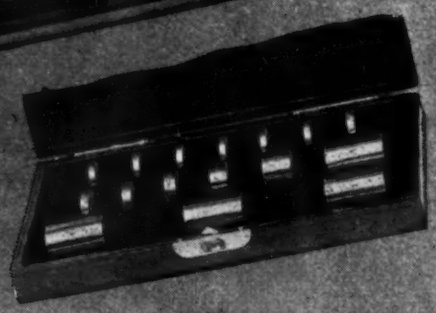
FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ... OHIO

Van Keuren



MICROGAGES

Set MTT MICROGAGES. 35 Gages giving 140,000 combinations $95.00



Set MT MICROGAGES Over 5,000 combinations in thousandths $55.00

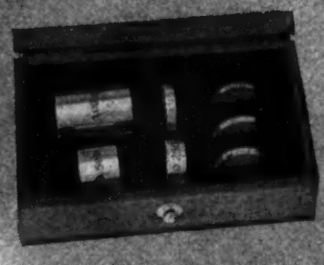
A FOUNDATION FOR ACCURACY FOR 25 YEARS

VAN KEUREN MICROGAGES are high precision working gages, designed for use on all ordinary work and economically practical for use in production because of their low cost. Their great value in general shop use lies in the fact that they enable the workman to achieve the accuracy required by the inspector.

MICROGAGES are of first quality oil hardening alloy tool steel, exceptionally hard, carefully seasoned, with accurately flat and parallel mirror-like surfaces. They combine readily by wringing together and because of their size (11/16" dia.) are ideally suited for checking heights; widths, slots, machine set-ups, gage setting and many other uses. They are made round in order to assure the best distribution of wearing surface, which is about equal to that of rectangular gage blocks.

MICROGAGES up to 1" in length have a tolerance of plus .000015" minus 000010" They average 5 millionths of an inch oversize which provides the WEAR ALLOWANCE feature of these gages.

VAN KEUREN MICROGAGES are available in sets especially designed for general shop use, for gage setting and for toolmakers and machinists. Individual MICROGAGES in standard sizes are also available in a size up to 6" in length.

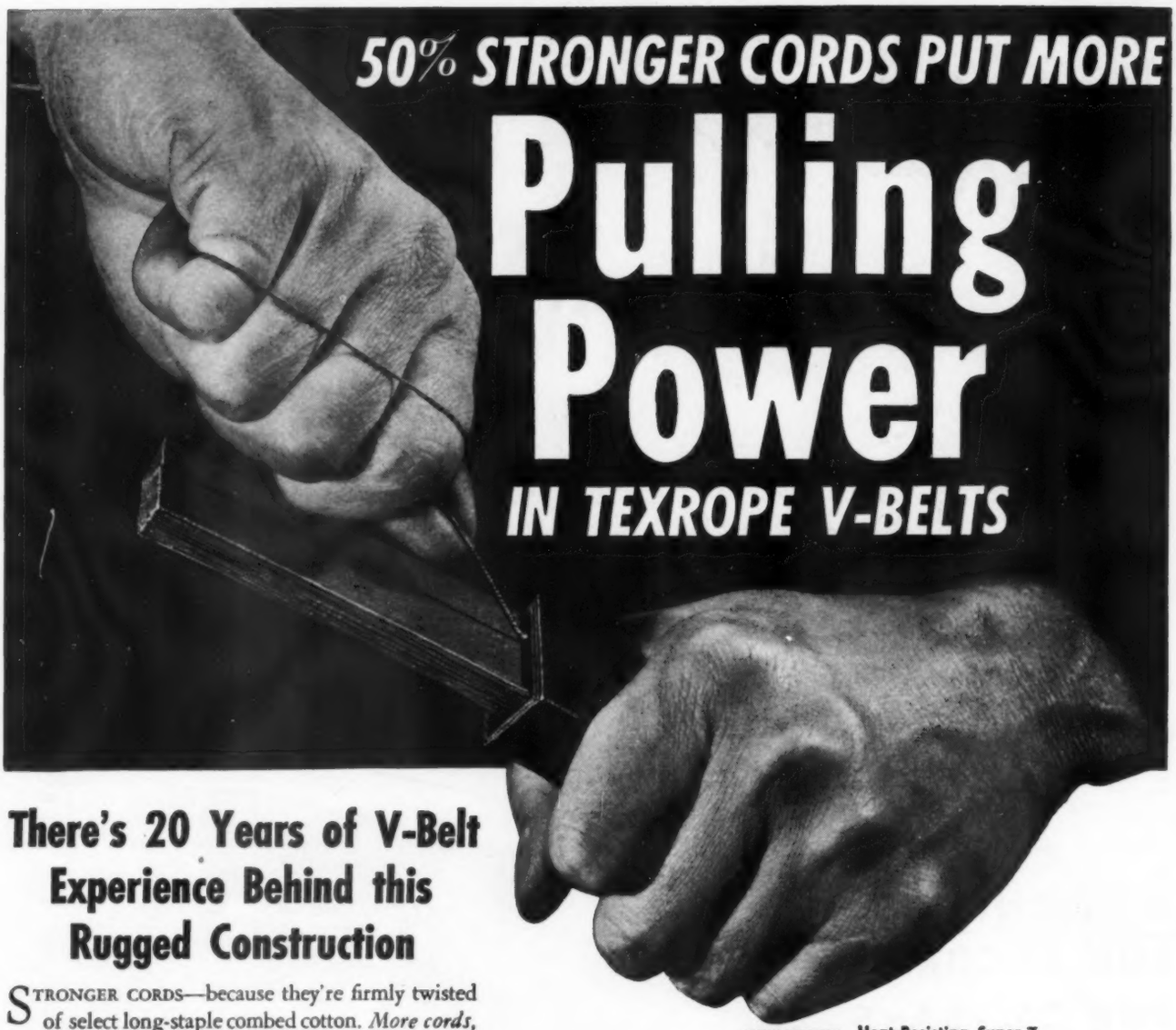


Toolmakers MICROGAGE SET M64. Gives 121 combinations. $15.00

Complete details on MICROGAGES and the full line of Van Keuren Precision Measuring Tools are contained in Catalog No. 33, a 168 page manual for toolmakers, machinists and inspectors—sent promptly on request.

Van Keuren Co. 176 WALTHAM STREET, WATERTOWN, MASS.

27th YEAR



50% STRONGER CORDS PUT MORE Pulling Power IN TEXROPE V-BELTS

There's 20 Years of V-Belt Experience Behind this Rugged Construction

STRONGER CORDS—because they're firmly twisted of select long-staple combed cotton. *More cords,* too — accurately placed to carry heavier loads, and impregnated with gum rubber to absorb friction and heat.

Texrope "Super-7" V-Belts today are the finest in 20 years of continuous development by Allis-Chalmers—originator of the multiple V-Belt drive.

LONG WEARING — COOL RUNNING

Tough duplex cover to take the wear, keep the belt in shape. *Thick cushion* of war-proved Buna-S to protect the cord structure from shock. *Precision molding* to assure accurate section and a smooth running belt. For long service and highest efficiency on ALL V-Belt drives — make A-C your V-Belt headquarters! ALLIS-CHALMERS, Milwaukee 1, Wis.

WHICH OF THESE SUPER-7 V-BELTS DO YOU NEED

TEXROPE offers you the most complete line of V-Belts — types specially developed to meet ALL operating conditions. Pick the right TEXROPE Super-7 V-Belt — it'll give you the most in efficient power transmission.

Heat-Resisting Super-7
Stands temperatures up to 180°. The TEXROPE V-Belt for most drives.

Oil-Resisting Super-7
Neoprene cover protects core against moderately oily or greasy conditions.

Oil-Proof Super-7
Made of Neoprene throughout. Use it when the belt must swim in oil.

Static-Resisting Super-7
Recommended where explosion hazard exists. Static-conducting element throughout cover won't wear off.

Super-7 Steel
Twin steel cables, to pull extremely heavy loads with minimum stretch.

GET THEM — through your Allis-Chalmers district office or dealer.

TEXROPE Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

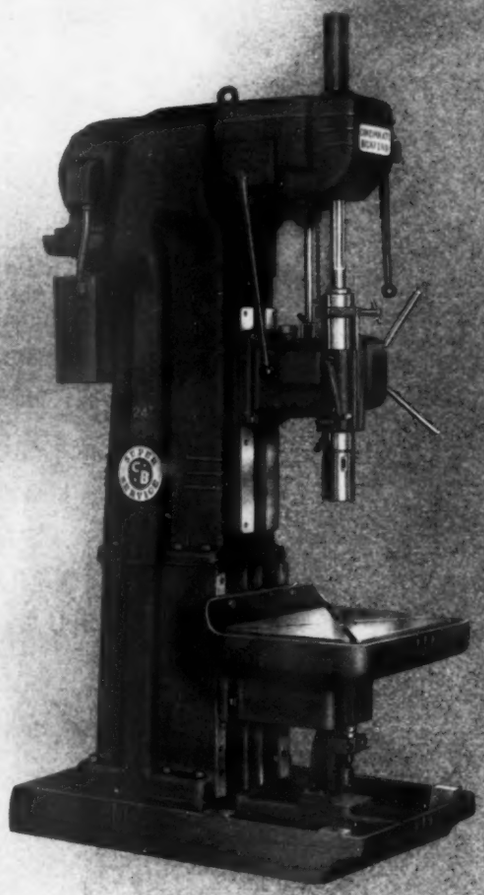
V-BELTS
TEXROPE complete line — Sizes, types for every power transmission problem and condition.

ALLIS CHALMERS
TEXROPE V-BELT DRIVES
ORIGINATORS OF THE MULTIPLE V-BELT DRIVE

SHEAVES
"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

A 2009

Attention } HIGH-PRODUCTION INDUSTRIES



NEW SUPER SERVICE DIRECT DRIVE UPRIGHT DRILLS

21" 24" 28"

These new manufacturing type machines are of interest to automotive, electrical equipment, home appliance, farm equipment, and many other mass production industries. They are designed to produce more holes per dollar in large scale operations. Capacities, ease of controls, speed adaptability, and simplicity make them low cost producers.

See our condensed catalog in Sweet's File.

Write for Booklet U-27 for details on these machines.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9. Ohio U.S.A.

The New METRO Heavy Duty Solid Shank and Shell Type EXPANDING REAMERS

HEAVY DUTY SOLID SHANK REAMER

HEAVY DUTY SHELL REAMER

FULL LENGTH CARBIDE BLADE

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American Machinist's

Spot NEWS OF METALWORKING

Surplus machine tools in long supply are being offered at 50% off the Clayton formula by WAA. The agency feels price concessions are only means of moving them.

Less than 10% of Japan's prewar machine tool factories were permanently disabled by the war. The great majority are ready to resume operations in much the same condition as when first built. Nevertheless no Japanese machine tool company is operating, except by special permission.

As much work could be got out in 32 hr. as in today's 40 hr. in opinion of an important metalworking company, if parts and materials could be delivered into its plants on time when wanted. Lack of steady supply is even more responsible than high wage rates or inefficiency at machines for soaring costs.

First twin-engined commercial helicopter is being developed by Kellett Aviation. It will be powered with two 550-hp. Continental engines and will carry 10 passengers.

Light aircraft industry is putting final assemblies near ultimate market areas, thus adopting mass production techniques of other industries.

> AFL ridicules CIO's buyers' strikes. Replying to AFL's sudden urge for increased production, CIO says that greater output doesn't help much because it puts more money in workers' pockets, thus increasing inflationary pressures.

Super-modern electro steel works, with capacity of 200,000 tons a year will be built in northern Norway near Arctic Circle. It will be financed by State grant. Facilities will be expanded later, to meet country's need for 400,000 tons annually.

Motor car companies are seeking machines, processes and methods which will pay for themselves in short time under present conditions. They are not proceeding as rapidly as planned in buying replacement machines in huge numbers. Poor earnings and inability to push up production are holding up much purchasing.

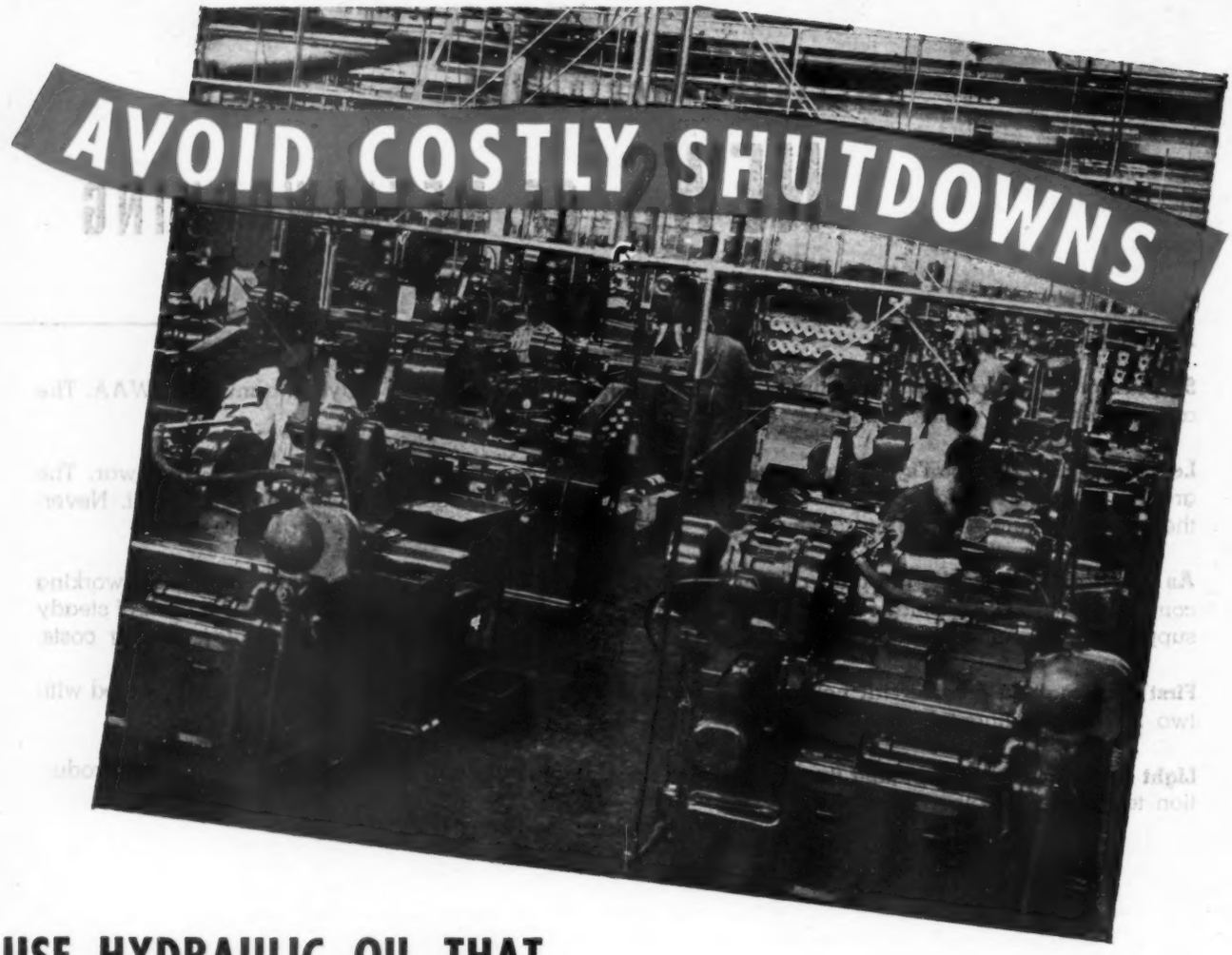
Method of changing the color of stainless steel by adding several elements to the alloy has been evolved at Stalin Steel Institute in Moscow. Steel thus treated takes on a golden hue. It is suitable for decorative architectural purposes.

Crating lumber is cause for much complaint by machinery builders. It is delivered so green that it almost drips water. Carefully wrapped machines and parts arrive at their destination with rust spots. Longer kiln drying would help, but skilled labor shortages and unprecedented demand are at the root of the trouble.

First experimental aluminum refrigerator car is being built by Illinois Central. It is all aluminum except for wheel construction, weight saving will be 14,000 lb.

Light plane production is rising again. Prospects are that 25,000 units will be turned out this year. Two or three companies are offering immediate deliveries, first hints that the pent-up demand is beginning to be filled.

Netherlands and Norway are buying in this country much heavy equipment — farm implements, cars and locomotives, ball bearings, machine tools, automobile parts, formerly secured in European countries.



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American Machinist

ESTABLISHED 1877

BURNHAM FINNEY, Editor

The Truth About Surplus Machines

A maximum of misinformation and a minimum of facts have been largely responsible for the confusion regarding surplus machine tools.

The confusion has existed among all interested parties—the government agencies involved, prospective buyers and the machine tool industry.

Some of it was inevitable. Never before had a problem of such magnitude presented itself. The organization of machinery to solve it took time and demanded an unusual degree of skill.

Much ineptness was shown by the selling agency, first the RFC and now WAA. It didn't know what it had to sell or where it was. And its district office men compounded confusion by interpreting the rules and policies to suit themselves.

At last, light is beginning to penetrate the darkness. Facts instead of rumors are being revealed; and WAA, with the help of machine tool dealers, is doing a more intelligent job of selling.

It still is true, however, that buyers often have trouble locating and purchasing the kind of machine tools which WAA itself advertises for sale. It obviously isn't smart for a seller to make it as hard as possible for a buyer to get what he wants.

The best news is that most of the government machine tools to be offered to the public have already been declared surplus and are now available to metalworking shops.

As a corollary, we learn that government holdings of machine tools never were as large as they were reputed to be.

Here are the facts. RFC and the armed services owned machine tools totaling about 400,000 units, compared with an earlier estimated 500,000 to 600,000. The Army and Navy wish to retain 80,000. That leaves 320,000 to be disposed of.

WAA reports that over 266,000 units have been declared surplus. The differences between 320,000 and 266,000, or 54,000 units, represents the number of machine tools yet to be declared surplus.

A considerable percentage of the 54,000 are concentrated in a small group of large plants and are of special design, making them unsuitable for use in producing civilian goods.

These figures, which are rough approximations, simplify the problem and indicate for the first time what is going on in surplus disposal and what both buyers and seller may expect during coming months.

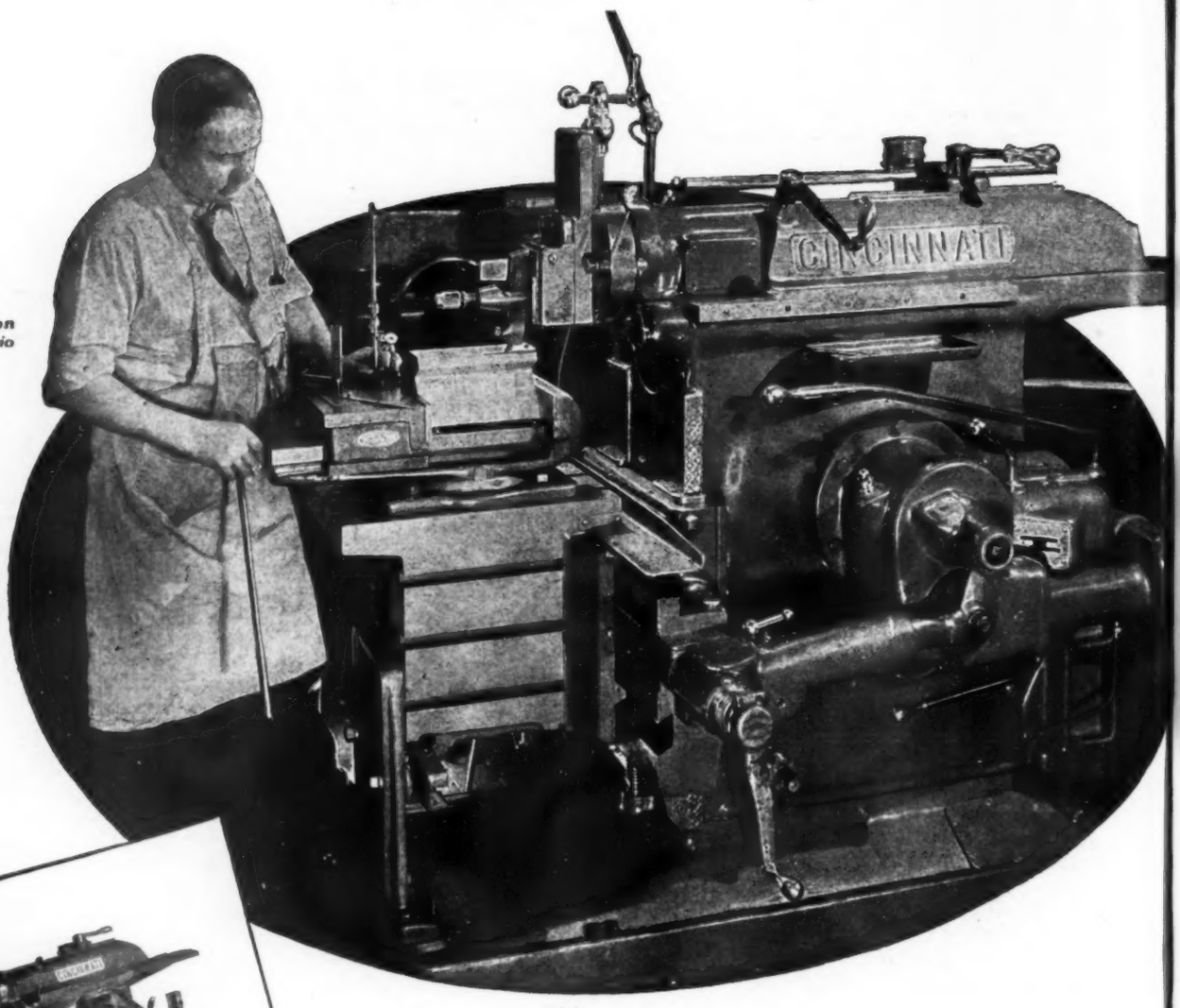
Clear-cut conclusions can be drawn from the facts now available. Government agencies possessing machine tools have declared them surplus and turned them over for sale to private buyers with uncommon speed. After all, the war ended only a year ago.

The surpluses are coming onto the market at the best possible time. Shops which need to be rehabilitated, particularly the smaller ones, can use surplus machines to far greater advantage now than a year hence. Moreover, the tools are being offered when the demand is at its peacetime height and when orders for new machine tools still are formidable. The least damage is likely to be done to the machine tool industry under these circumstances.

In short, the surplus situation could be much worse than it is. Despite all of the weird stories of mismanagement which still come to hand, and without underestimating the very serious effect upon individual machine tool builders, it promises to aid our economy more and have a less unsettling effect upon the machine tool industry than many people anticipated.

Burnham Finney

ACCURACY FIRST...



Courtesy of
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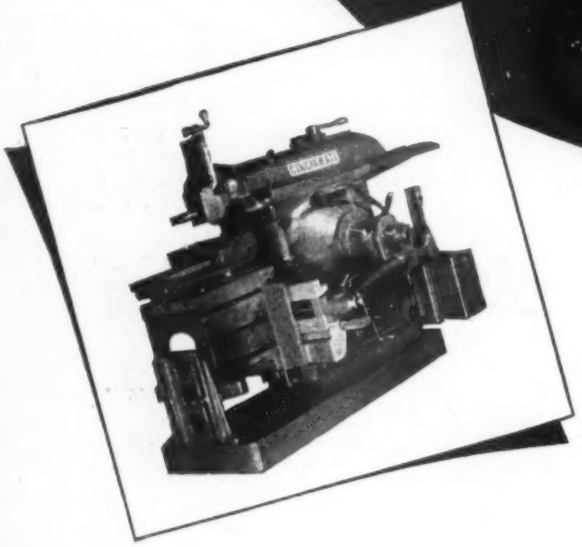

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SHAPERS · SHEARS · BRAKES

Keys Replace Pockets in Die Shoes

BY WALTER J. KAMP, SUPERVISOR OF DIE DESIGN
CATERPILLAR TRACTOR CO.

Tool steel and milling time cut when working elements of dies are backed up by machinable keys set in shallow slots and ground to fit the supported part

BACKING up working members of a die assembly to resist side thrusts has been a major concern of the die designer since it first was found possible to blank, pierce and form metal in press dies. Inward or outward side thrusts on the hardened-steel die members frequently are high. In forming and cutting heavy metals, is impossible to insure reasonable die life if some form of back-up is not used.

Until recently, the principal method of backing up was to mill a pocket into the die shoe to a depth of ¼ to ½ in., and to close tolerances. Fitting pockets to the contours of some punch and die members was quite a problem. Usually pockets were milled with small-diameter cutters and any misalignment of the spindle or the cutter would be reflected in the surfaces produced. Finish cuts consumed considerable time, as it was necessary to use very fine feeds, especially on vertical walls.

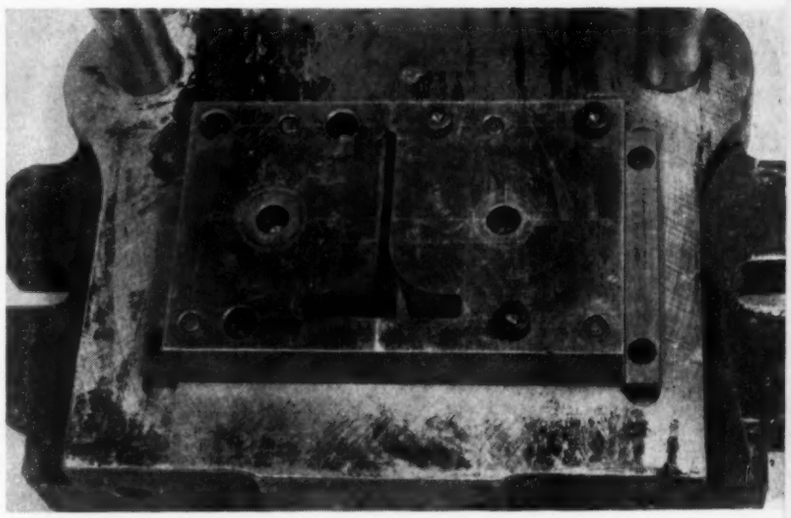
In addition, many tool steels grow or shrink when heat-treated. It is, therefore, necessary to estimate the amount of this creep when milling pockets. Often it is necessary to grind the steel punch or die members to make them fit the pockets, or to shim in the pockets to make the die members fit properly.

Caterpillar Tractor Co. some time ago set out to find some means by which these conditions could be improved. The ideal would be to mount die parts on the shoe face, with no pockets, but without additional back-up it would not be possible to resist the forces encountered without shearing the dowels and screws which hold the tool-steel members in place.

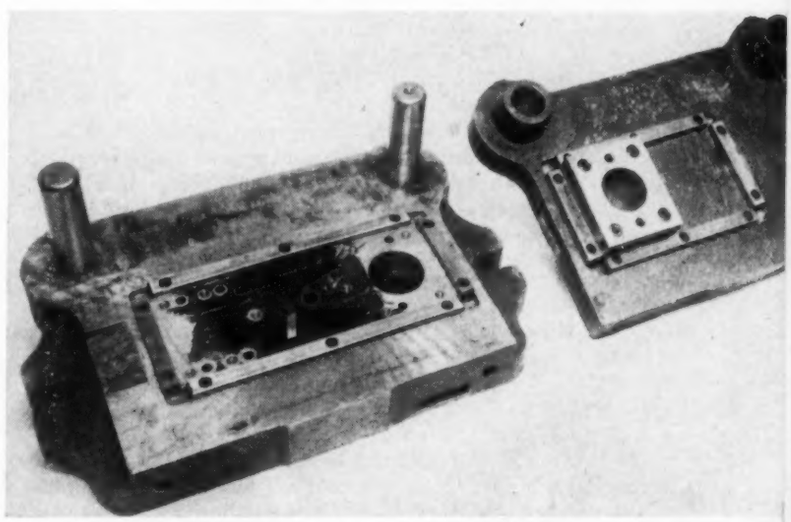
However, in machines and tools where a dowel does not provide sufficient area to resist shearing action, keys are used. So, if a key will provide this resistance to thrust forces, why not use it to back up the tool-steel members in dies?

To try out this theory, several dies were built with punch and die members backed up with keys. They proved very successful. Surfaces of the die sets on which the members were to rest were found to be sufficiently flat and true as received from the vendors. Keyways were milled to fractional dimensions for location, with the keyway machined for a press fit to the key in each case. Then keys were fitted in the slots and fastened to the die shoes with capscrews.

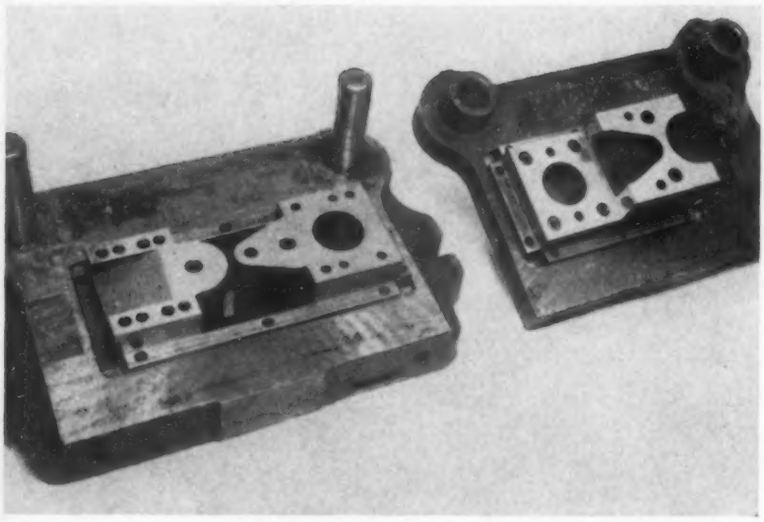
Tool-steel die members for one side of the die, either top or bottom—whichever is most advantageous, are finish-machined on working contours, then hardened and ground. These members are placed on the die shoe



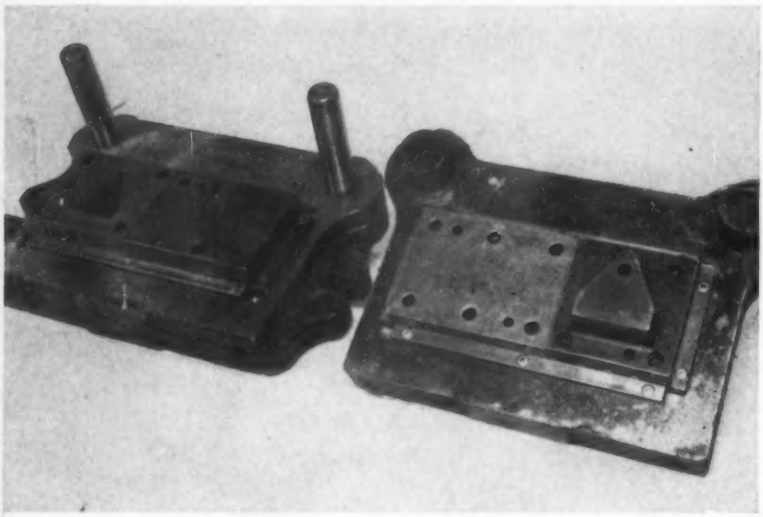
Two SAE-1020 soft-steel keys provide adequate back-up for the two hardened tool-steel die members in this assembly. This arrangement is considerably less expensive than would be the machining of a pocket in the die shoe to locate the hardened parts



Simplicity of the key method for backing up punch and die parts is well illustrated in this view of a piercing die under construction in the Caterpillar plant. In almost every case, keys are soft SAE-1020 standard key stock, with the size of the key being determined by the nature of the job and the thickness of the material being worked



Often, a single key can be used advantageously to back up more than one detail. The key system is flexible and can be varied to suit conditions. Punches and other die members also can be cross-keyed in their bases



Punch and die members of this simple piercing and flattening die adequately are backed up with keys in the punch and die shoes. This method is used for small die sets as well as for large sets employed in heavy-duty hydraulic presses for blanking and piercing heavy steel plate

within the keys. In the event of growth or shrinkage, keys can be adjusted by grinding steps on their side faces or by adding metal to these faces by welding, then grinding them true. This is less expensive and considerably better than shimming or grinding steps into finished tool-steel members.

After one member of the die is completed, it is a simple matter to scribe the other member while still soft, using the finished member as a templet, then rough-machine the soft member and shear it to the hardened member. Finally, proper clearance is machined from sheared faces.

Some advantages of this method of mounting are:

1. Flat surfaces of the die shoes can be used as received from the vendor. In extreme cases, these surfaces are easily scraped to provide precision flat working surfaces. This is less expensive than the long and tedious job of milling pockets into the faces of the die shoes.

2. Keyways can easily be machined accurately.

3. Keys are easily adjusted for change of size of tool-steel members resulting from heat-treatment.

4. Height of tool-steel members can be made less than when pockets are milled in the shoes. This alone is a considerable cost saving in a large number of dies.

5. With the lower height of tool-steel members, these members can be made somewhat narrower in width without increasing the possibility of tipping, thus making additional savings in tool-steel costs.

6. Engineering changes to the part being made in the die can be taken care of readily, as it is easy to plug the keyway slots and machine new ones to suit the new die members. For minor changes, keys can be stepped.

7. For irregular contours, keys can be fitted to the contour of the hardened tool-steel punch or die member and the slot milled to clear the key. In these cases, the back-up side of the slot is kept straight.

8. Where conditions permit, hardened tool-steel punch or die members can have keyways machined into their bases with mating keyways milled into the die-shoe surface. In this way, one key in either direction will absorb thrusts from any direction in a horizontal plane. This works well in drawing and forming dies, especially larger dies for heavy materials.

For ordinary female die members, keys on the outside will suffice. Punches or male die members should be keyed all the way around, or cross-keyed in their bases. For compound dies, where the steel cuts on inside and outside edges, it is necessary to key on both sides.

Some designers contend it is not mandatory to back up steel members that cut on both sides, but experience has proved this is not the case. Shear on the steel die members, or sometimes, dulling of the cutting edge on one side, causes a shift which at times will shear dowels and in some cases the capscrews. This shifting also will cause tool-steel members to crack, chip or spall. In extreme cases, where a weak back-up is used or where leader pins are depended upon entirely to absorb the side thrusts, an entire die can be ruined.

Key sizes and the depth of the keyways generally are determined by the nature of the job, and by estimates of the thrust pressures to be encountered, depending upon the thickness of the material being worked. Special cases require special consideration, but a good general rule for keys used with blanking and piercing dies is:

Stock Thickness, in.	*Size of Key, in.*
Up to 1/6	No keys
1/6 to 1/8	1/2
9/64 to 15/64	5/8
1/4 to 3/8	3/4
3/8 to 1/2	1
9/16 to 1	1 1/4

Keys usually are made from standard square key stock of SAE-1020 steel in lengths not to exceed 12 in. They are set in the die shoes to a depth of half their thickness.

Usually each piece of tool steel in the punch or die is backed up by its own key, but at times it is advantageous to back up more than one detail with a single key, or parts of more than one detail with a single key.

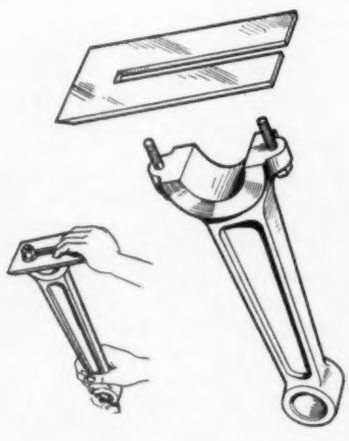
This method of backing up punch and die members was selected because of its flexibility and cost-reduction possibilities. Consequently, hard and fast rules for its application were not set down. Up to the present time, several hundred dies have been built with key back-ups and this method is now standard at Caterpillar plants.

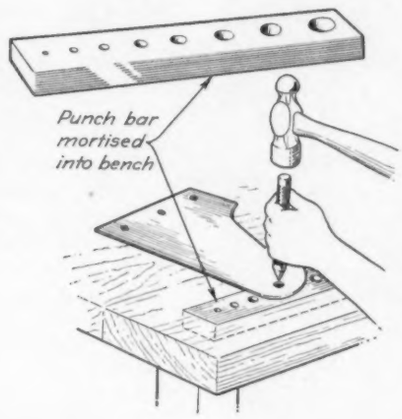
Short Cuts FOR THE SMALL SHOP

BY A. H. WAYCHOFF

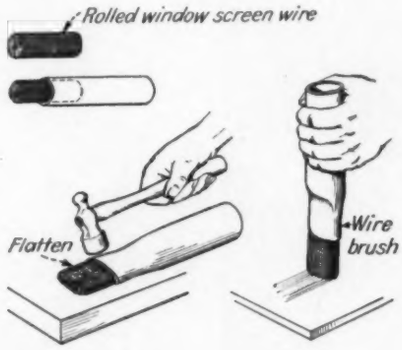
A FLAME GUARD on the blow torch localizes the heat and avoids damage to nearby parts. Roll about two turns of window-screen wire into a cylinder about twice as long as the blow-torch head. Fasten the guard in place with wire. Then when the blow torch is lit, a tip of heat is available to solder connections or remove bushings.

A TWO-HAND SCRAPER for heavy and close work is handily made from a scrap connecting rod. First make a slotted blade from an old handsaw blade or other thin steel stock of good quality. Fasten the blade to the bearing-cap face of the rod by nuts applied to the studs. Of course, the blade can be adjusted at will and is easily resharpened.



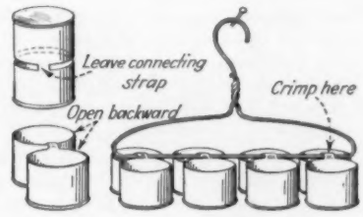


PUNCH BARS on work benches save a lot of time in shops doing sheet-metal work. A convenient size is from 10 to 12 in. long, 1½ in. wide and ½ in. thick. Drill a row of holes of assorted, needed sizes along the bar. Mortise the bench edge so that the top of the punch bar sets flush. Most common method of using the block is this: position the sheet and drive a center punch into the proper size hole. If driven through far enough, the punch will shear the burr against the sharp edge of the hole.

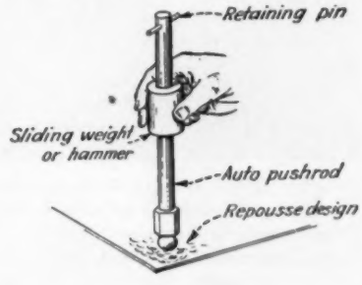


WIRE BRUSHES shaped like a paint brush can be made in this way: Cut a strip of window screen wire about 3 in. wide, roll up, and insert halfway into a piece of scrap tubing. Flatten the protruding end of the wire roll and the wire brush is ready for use.

CARRIERS for repair parts, nails, screws and other small items are made up in infinite variety. Some people like one kind; others prefer a different style. Here is one that has much to recommend it. Cut around the center of four tall milk cans, leaving about one inch uncut. Bend the ends open and set the connecting straps over the cross wire of a strong metal clotheshanger. Squeeze the connecting straps about the cross wire so they won't slip off, and so that the bottoms of the half-size cans are parallel. The hanger hook can be put on a nail or a ladder leg, and when the carrier is set on the floor, the hangar lays over out of the way like a bucket bail.



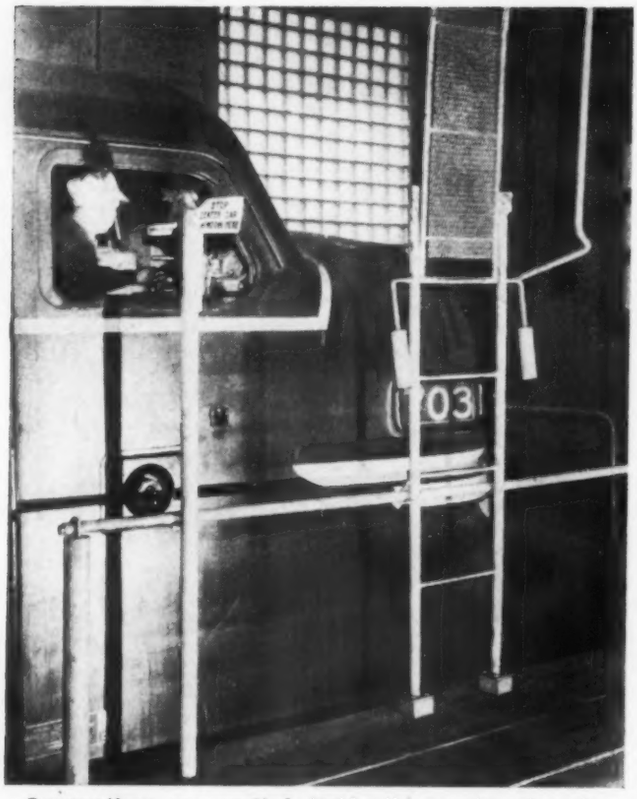
A HAMMER for repousse work on thin sheet brass, copper or aluminum can be made from an old automobile-engine pushrod. Cut a 2-in. length from a piece of 1-in. shafting and drill a lengthwise hole for a sliding fit on the pushrod. Drill a pin hole in the end of the pushrod and make a retaining pin. Assemble the tool as shown. To use the hammer, simply keep the ball end on the work and slide the weight, or hammer, up and down, using as much force on the down-stroke as needed for the job.



Diesel Locomotives

BY F. D. KENNEDY, MASTER MECHANIC

Erie Railroad establishes repair and maintenance station to keep diesel-electric locomotives in A-1 shape for a grueling, 400-mile freight run



Locomotives are spotted inside the service shop by centering the engineer's cab window at indicating sign. This locates each door in the four locomotive units opposite openings in the pipe rail alongside the floor-level platform. Truck axles rest over hot-air ducts for removal of snow and ice in winter. Smoke jacks suspended above the pits carry away exhaust from the four engine stacks. Before entering the shop, locomotive fuel tanks and sandboxes are refilled, and trucks are cleaned with four high-pressure water jets. The ladder has a counterbalanced platform which can be lowered over cab for cleaning windshields and, adjusting wipers

Greater safety results from use of this gantry support for cords of extension lights and portable power tools. By suspending cords overhead, the working platform is kept clear of hazardous obstacles. Hooks hold lamps and cord when they are not in use

TIME-CONSUMING DELAYS in breaking up long freight trains into sections to negotiate heavy grades on the 200-mile run between Marion, O., and Meadville, Pa., have been overcome by the Erie Railroad Company in replacing steam locomotives with modern diesel-electrics. A full-tonnage train of from 100 to 110 cars can now be hauled from one end of the line to the other without splitting it into sections.

Six four-unit, Electro-Motive diesels, each of 5,400-hp. capacity, operate in a pool. Because they must be ready to handle freights on relatively short notice, the diesels must be maintained in first-class condition.

The Erie has established a super-service station to cope with problems of swift repair, servicing, and progressive maintenance operations. This station is equipped with modern facilities and is specially designed to handle repair and maintenance operations in minimum time.

Repair shops installed in a central building are equipped to make all major locomotive repairs, whether they involve replacement of a generator or diesel engine, or the overhauling of a traction motor. Spare traction motors, trucks, generators, and even a spare diesel engine are kept in stock for installation on short notice.

The super-service station at Marion is a 113-ft. wide, 222-ft. long concrete-and-steel-frame structure having brick and glass-block walls. It is divided into two departments—service shop and repair shop. The service shop is used for terminal inspection, servicing and progressive maintenance operation. It has two 200-ft. long, 4-ft. deep engine pits. Flooring beside the pits is depressed 2 ft., 9 in. below the track level for easy side access to trucks under the locomotives.

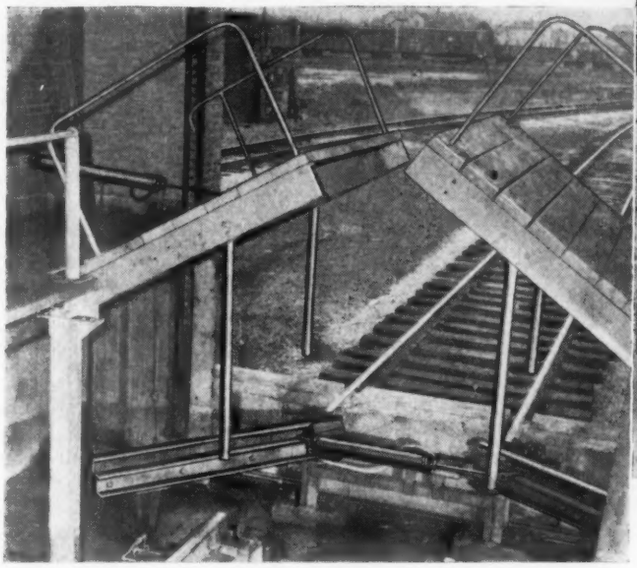
Elevated service platforms at locomotive floor height permit easy entrance to locomotive engine rooms. The platforms are 4 ft. 8 in. above track level, and support pipes for lubricating oil, scavenging oil, distilled water, compressed air, and steam. Smoke jacks equipped with suction fans draw off gases from locomotive exhausts.

Each diesel-electric freight locomotive is brought to the service shop at the end of the 400-mile Marion-Meadville round-trip. This takes place at least once every 24 hr., sometimes oftener. Besides regular servicing and inspection, the diesels are given progressive maintenance to meet mileage requirements.

Operating conditions of the freight locomotives are different than the average encountered on other roads. Thus the routine maintenance schedule differs to some extent from original recommendations of the manufacturer. Under the setup, each locomotive averages only 2 hr. for each servicing, including refueling and resanding, terminal and daily inspection, and specified progressive maintenance as worked out in chart form by Erie operating men and Electro-Motive service engineers. Most operations are performed at the Marion diesel shops, but Electro-Motive does some repair work on contract.

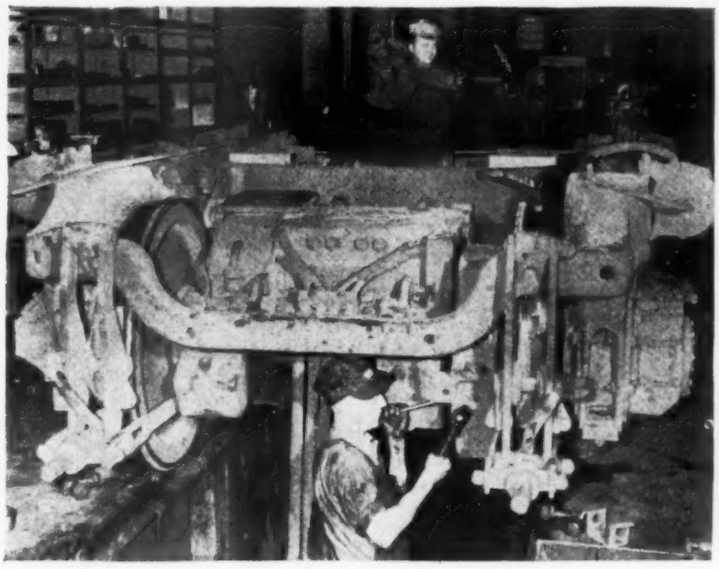
Get Super Service

KENT DIVISION, ERIE RAILROAD COMPANY

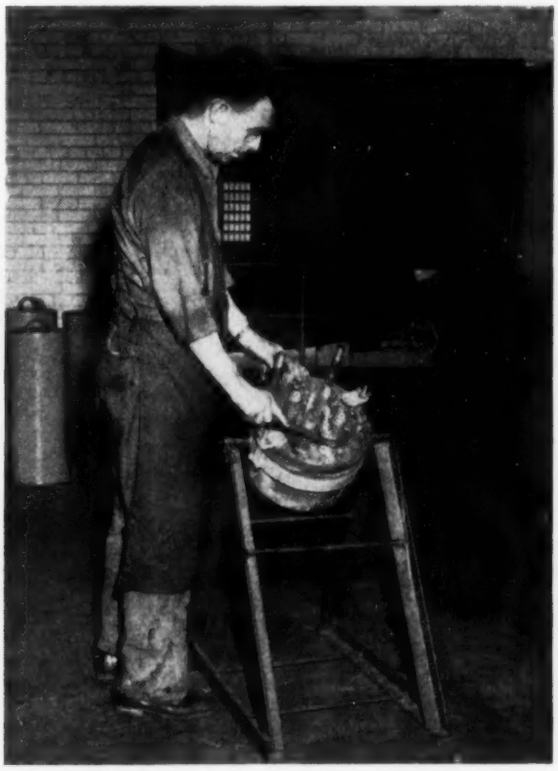


Double-end tracks avoid the necessity of backing locomotives out of the shop when service and maintenance work is completed. A drawbridge at the forward end of each pit can be lowered when the engine is being serviced and then raised so the locomotive can move forward out of the shop. Drawbridges are synchronized with swinging track sections on the lower level for passage from pit tracks to tracks outside the building. Pneumatic cylinders controlled by solenoid valves operate platforms and track sections. Controls for the valves and motor-operated door are centralized in pushbutton stations

A lever-action tool developed by Erie servicemen positions heavy electrical connectors under the locomotive. The 4-ft. deep pits are floodlighted for inspection and maintenance work

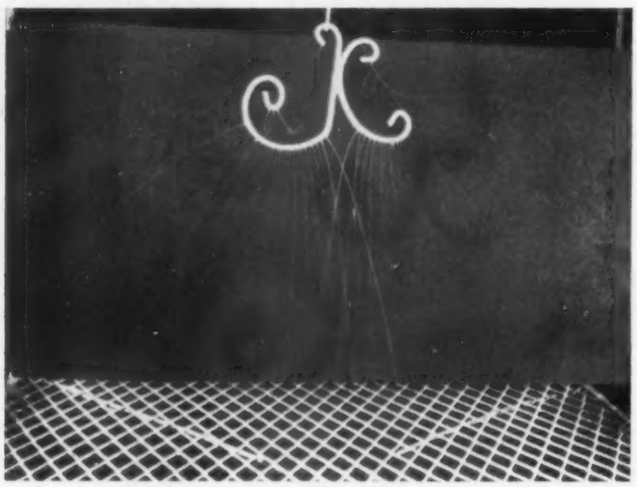


Complete truck units are removed and replaced with spare units within 1 to 1½ hr. A 60-ton Whiting drop table is used for removing trucks when extensive repairs are necessary. A tunnel running under all four sets of tracks permits use of the drop table in the service shop and repair shop



Gaining experience in servicing and repairing diesel-electrics, Erie shop employees are developing special tools and fixtures to help simplify maintenance operations. The rack shown was developed by Machinist H. S. Moak to hold diesel cylinder heads for servicing

Static Makes Dipped Coatings Shed Tears



BY DR. EMERY P. MILLER
HARPER J. RANSBURG COMPANY

Excess paint or other finishing material, which accumulates at drain-off points on dip or flow coated work, can be pulled off by an electrostatic field as a conveyor carries them through it

Strong attraction between negatively charged grid and positive work, produced by electrostatic field, causes excess paint to spurt from drain-off points in minute streams, dropping to the grid along electrostatic lines of force. Time required for detearing most parts is 15 sec. to one minute

DIP AND FLOW coating with paint and other liquid finishes has many advantages, particularly where production justifies a conveyor. On a wide variety of parts, coating is applied rapidly and evenly at low labor cost. However, these methods have limitations, the most serious of which usually is accumulation of finishing material, or "tears," at drain-off points. These accumulated "fatty" edges of surplus not only spoil uniformity of the finish, but require baking ovens capable of drying the heaviest section of the coat. Electrostatic detearing, as an auxiliary operation, automatically removes this excess coating material.

In electrostatic detearing, work is suspended from an overhead conveyor in the usual fashion. After the item has been dipped, it is carried over the usual gravity drain board and allowed to airdry until flow of surplus paint has practically ceased. Then items are carried over and in spaced relation to a metal grid electrostatically charged by a suitable power source. As in electrostatic spraying, the work is grounded and positive. The grid is negative, and usually is maintained at a potential of 85,000 volts dc.

As unlike electrostatic charges attract and like charges repel, an attractive force is exerted upon items as they are carried across the grid. Therefore, any fluid excess coating material is attracted to the grid and so removed from the drain-off points. Removal will continue as long as the item is over the grid, or as long as there is excess coating to be removed. As flow of coating on the parts has substantially ceased and the electrostatic field has removed excess material from drain-off points, parts leave the grid uniformly coated. Time required for detearing most parts ranges from 15 sec. to 1 min.

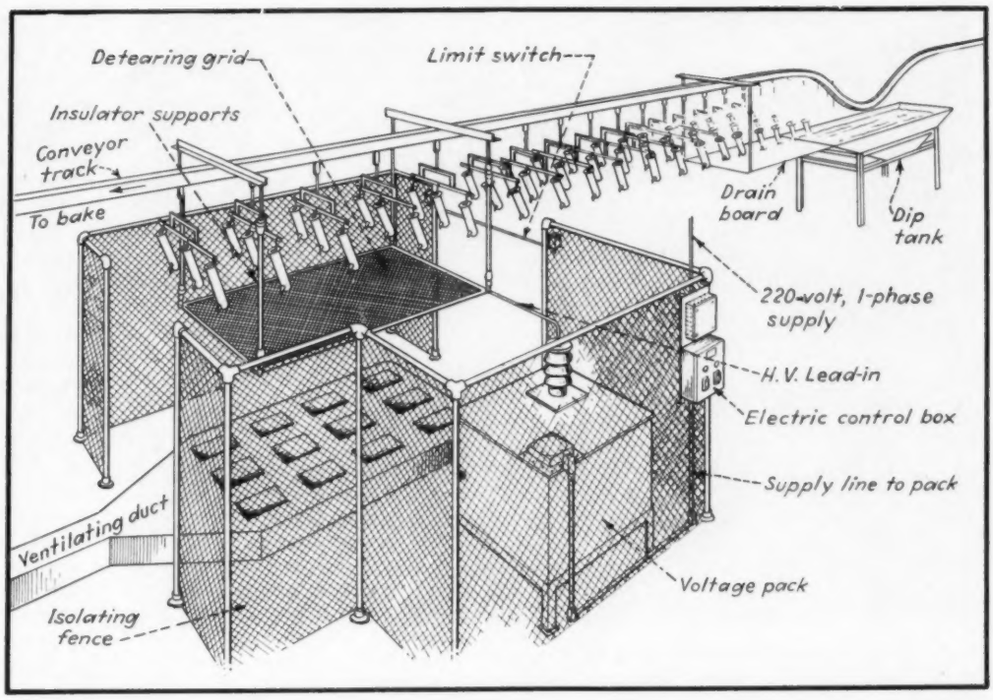
The electric field used is a direct voltage field pulsated from zero to a maximum once every sixtieth of a second. Average current through the field is approximately 0.4 milliampere. The power pack has an over-control characteristic which automatically decreases voltage when current tends to exceed this value. On direct short circuit of the equipment, maximum current which can be drawn is 7 milliamperes. The power pack is connected to a standard 220-volt, single-phase, 60-cycle, ac. line capable of delivering approximately 10 amp. Normal power consumption is equivalent to a 1,000-watt light bulb.

Current and voltage characteristics of the field are maintained constant regardless of the size or shape of the item passed over the grid, and are held constant regardless of the type of coating material used. Detearing is independent to a wide degree of the type of coating material.

Conveyor speed is not determined by the limitations of the method, but by the production volume required. It is important, however, that dipped parts be allowed to drain properly before arriving over the grid, and that they remain over the grid long enough so no new tears will be formed afterward. These two requirements, when combined with production requirements and space available, determine conveyor speed. To decrease conveyor speed, it is possible to hang the items in groups perpendicular to the conveyor. Thus, for any given production, hanging two items on each hook instead of one would reduce required conveyor speed by half.

The electrode system usually consists of an expanded-metal grid supported below or to one side of the path of the work. The grid is mounted on supporting insulators. Normally, it is necessary to maintain between the grid and closest drain-off points on articles a distance of approximately 8 in. Spacing may be increased from 12 to 15 in. without materially influencing detearing. It is preferrable that all points to be deteared pass over the grid at approximately the same distance. Because of this requirement, it is customary to support items of different sizes on hooks of varying lengths.

It is not possible to allow the drain-off point on a part to approach closer to the grid then 8 in. because decreasing this distance increases the possibility of static sparks between grid and parts. Additional detearing action obtained by decreasing the distance between the parts and the grid does not justify this increased hazard. For this reason, there usually is placed ahead of the detearing grid a limit switch which deenergizes the electrical equipment when a part is hung on the conveyor so it approaches the grid closer than the specified distance.



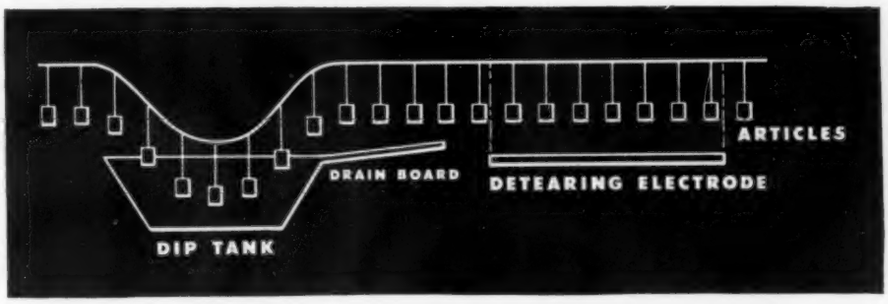
Typical arrangement of a negative detearing grid, voltage pack and electrical controls for electrostatic detearing. Ventilating ducts are placed below the grids in this installation to draw air down over the articles to prevent accumulation of solvent vapors and to aid in setting the flow of the finishing materials. A limit switch shuts off power if parts are hung from conveyor so they will be closer than 8 in. from charged detearing grids

Objects being deteared must be grounded electrically and have an adequate electrical connection to the conveyor so they form one terminal of the field. For this reason, items of non-conducting materials can be deteared satisfactorily only as long as the drain-off points are not too far away from the point of support. This distance is determined by the relative electrical conductivity of the material of which the article is made; no definite value can be stated without making tests on the items involved.

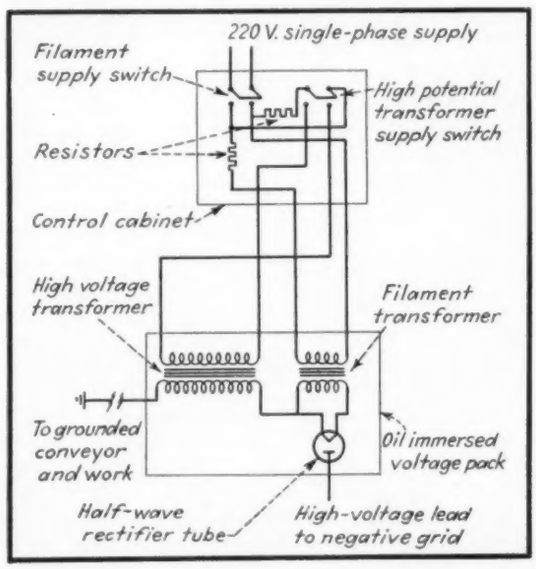
Finishing material removed from parts as they pass over the electrostatic grid is attracted to, and collects on, the grid. This usually is not a disadvantage because the amount of material collected during a production operation usually is very small and does not influence the field. In the event that accumulations do prove objectionable, the electrode system is made so it is easy to change grids without objectionable shutdown time.

In normal installations, grids and coated articles are ventilated to insure that solvent vapors are not accumulated in the area. Ventilating ducts may be placed above the conveyor or below the grids as desired. As the air passes through the grids and about the articles, solvent vapors are removed and the setting of the material is aided to prevent reflow after detearing has been completed.

It also is important that drain-off points be of reasonably small radius so removal can be complete. Best results are obtained when this radius is less than ¼ in. When the radius is larger, field strength is reduced and

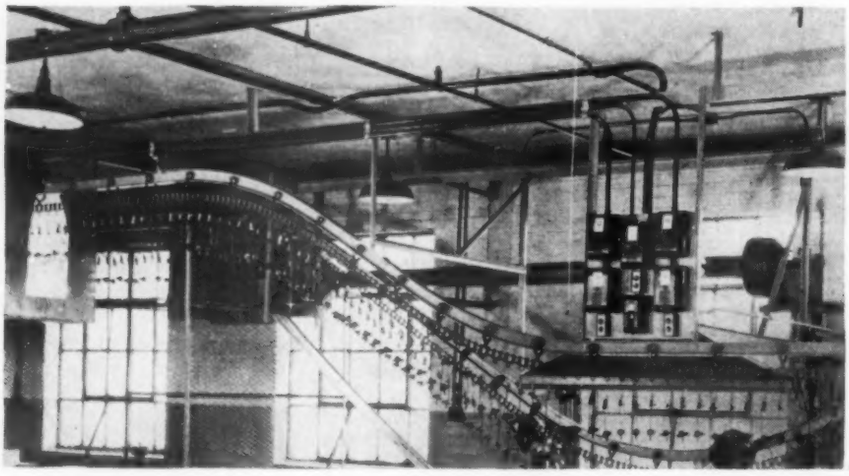


In normal electrostatic detearing, articles are hung from a conveyor in the usual manner, passed through a dip tank, carried over a drainboard which returns the major part of drained excess paint to the tank, then moved across electrostatically charged detearing electrodes which exert an attractive force sufficient to draw off the last drip or "tear"



Power pack for charging detearing grids includes high-reactance transformer and hot-cathode high-vacuum rectified tube. Short-circuit current is 7 milliamperes, but actual operating current is about 200 microamperes

Excess finishing material is removed from dipped refrigerator shelves in this electrostatic detearing installation. The shelves are given two coats of material and the conveyor therefore makes two passes through the dip tanks, across drain boards, then across detearing grids



Small automotive parts are dip-coated and deteared in this installation. Dip tank and drainboard are movable so change of color, or of finishing material, can be accomplished easily. Two motor-driven agitators keep finishing material in the dip tank thoroughly mixed. In this installation, the grid is overhead, above the voltage pack, and just in front of the infra-red drying tunnel

attraction forces are proportionately smaller.

The process is applicable to all types of coating materials in normal use, as long as these materials can be used in a dip or flow coating process to produce an otherwise desirable finish. Extremely heavy and viscous materials do not have necessary flow characteristics. Materials suspended in a water base are not deteared as effectively as are other type of finishing materials. Electrostatic detearing only removes excess coating material from drain-off points; it plays no part in aiding or speeding the flow of the coating material over flat surfaces.

In general, this method is applicable to any item whose shape is such that a satisfactory coating can be obtained over the major portion of the part by normal dip. It is, therefore, essential that articles do not have any sections which trap or pocket liquid and which, therefore, prevent free drain of the coating material to an exposed drain-off point. Items so shaped that their normal drain-off points are enclosed or shielded from action of the grids also offer some difficulty.

The electrostatic detearing process is being used to detear dipped refrigerator shelves, automobile headlamp parts, sundry automobile parts, lock bodies, builders hardware, metal furniture parts, venetian-blind parts, parts for oxide rectifiers, refrigerator dehydrators, metallic wrought-iron floor stands, photographic reels, metal toys and similar articles. This process, although it does not save any coating material, does permit the use of dipping on items which normally would have to be sprayed. On all items to which it is applied, it affords a better and more uniform coat.

Experience with the process indicates that when equipment is installed properly, there is little hazard to person or property. Shocks, while uncomfortable, are not considered a primary hazard. The detearing area usually is enclosed by suitable shields or fences to avoid danger of shocks. Automatic control should be provided to make the entire electrostatic equipment "dead" when vent fans and conveyors stop.

Automatic Preforming Press Reduces Molding Cycles

Reduction of molding cycles on large plastic parts made of high-bulk phenolic materials has been one of the trying technical problems and commercial needs of the plastics industry. Development of a semi-automatic preform press by General Electric engineers, permitting these high-bulk materials to be performed into units weighing as much as one pound, has reduced molding cycles by as much as 50%. Because it was not possible to preheat non-formed phenolic compound by dielectric units much time was lost in both loading the mold and holding a long curing cycle. The external loading of machines adds a safety factor.

Heavy Hauling

During the war years commerical motor vehicles hauled about 5,640,000,000 tons of goods and materials from mines and factories to fighting forces and civilian consumers, according to the Office of Defense Transportation.

TALKING SHOP

Heat and Neck

AT ELGIN'S Sapphire Division, rough-drilled watch jewels had to be strung on a wire for mounting in beeswax before honing of the bores with a stepped wire. The wire to be run through, though only 0.010 in. in diameter, was a close fit, and couldn't be threaded through easily. Diameter was so small, pointing was difficult. The girl who had the job talked it over with the old German where she lived. He remembered an Old Country job like it. You spot-heat the wire and pull it apart. The resulting necking before fracture gives a nice long point. Worked like a charm, according to Roger Waindle, general manager.

Shot Peening Again

ALUMINUM die castings are being shot peened to eliminate surface porosity, aluminum portable-drill handles similarly treated before painting to cut out a 3-min. surface-polishing operation.

Flying Casket

CHROME-NICKEL ALLOY casket shells will soon be coming off lines at 1000 a month, according to the Metal Products Division of Ryan Aeronautical, which reports $350,000 worth of orders the first week. Come to think of it, there is a vague similarity between fuselage and casket shell—more so than between an airplane and a washing machine or toaster. Meantime we hear there's a shortage of caskets—no wood.

Old Joints

IN ONE double-extra-heavy hydraulic system, all joints were simple stepped type, flanged, and with copper gaskets. On 900-psi. test, one leak developed. In service over the last 20 years at 1500 lb., with shock loading, etc., no further leaks have developed.

Hydroplane

BEATTY Machine & Mfg., Hammond, Ind., had an old belt-driven Cleveland planer, too slow for modern conditions. Crawford Beatty had a cylinder and piston built on to the end of the table, added a motor-driven hydraulic pump—and now gets cutting speeds of 50 sfpm. instead of the former 15, return speed of 100 sfpm. instead of the original 47.

Diagnosis

A large maker of rolling stock was plagued with leaky pipe joints, which examiners decided flatly must be a result of faulty material in the pipe. Every joint leaked; all showed torn and rough threads. Pipe company investigators, however, suggested and found another cause: The chasers were inverted in the user's threading machines. As a result, all joints had straight threads, torn onto the pipe.

Four at a Time

TO GET faster shearing of 5/16-in. rods, one shop set up an ordinary straight shear with a lower blade having four semicircular slots. Rods are fed through against a stop, and cut four at a time.

Buyer's Strike

WE WERE spending the lunch hour getting set for a furnace-exit photo at A. O. Smith. Our guide met the call of the inner man by rustling up box lunches and pints of milk. When the furnace crew saw the bottles, they raised howls of protest. With the end of OPA, the milk dealer had raised the price of pints to 10 cents—and the whole plant had gone on a buyer's strike against milk. Our pints were the only ones bought that day. Sorry, Bossy, we can't cross a picket line.

Baby Dies

Fabricators of large steel sections frequently test new designs with a wooden die and tinplate. In one case we heard about, the die department insisted that a new engineering design couldn't be formed; the shop proved it could with a baby die. In another, engineering said "Impossible!" The shop said "Oh yeah!"—and produced a model.

Essential

"ONE of the most essential principles of sound managerial technique is that authority should not be separated from responsibility."—*Alfred P. Sloan, Jr., chairman of the General Motors Board of Directors.*

Oiling Helps

A SHOP we know about has two hydraulic accumulators with 32-in. pistons having 19 ft. stroke on its 1500-psi. system. The first one went in about 1924, required repacking of the gland every two weeks to a month. That took the accumulator out of service for 24 hr., cost the time of five men and $50 worth of packing. In 1937, when the second went in, the shop superintendent insisted on a design modification: oil holes at the top through the gland ring and just below the shoulder supporting the lowest ring of packing. These were piped to a hand pump so the pump man could force in a little oil before pressure went on the system in the morning. The original packing has been in service ever since, with only two adjustments of the gland ring and no repacking.

For those interested, the lowest row of packing is 1¼-in. square braided copper, with alternate rows of 1¼-in. square duck and 1¼-in. square braided flax above, topped by two chevron rings.

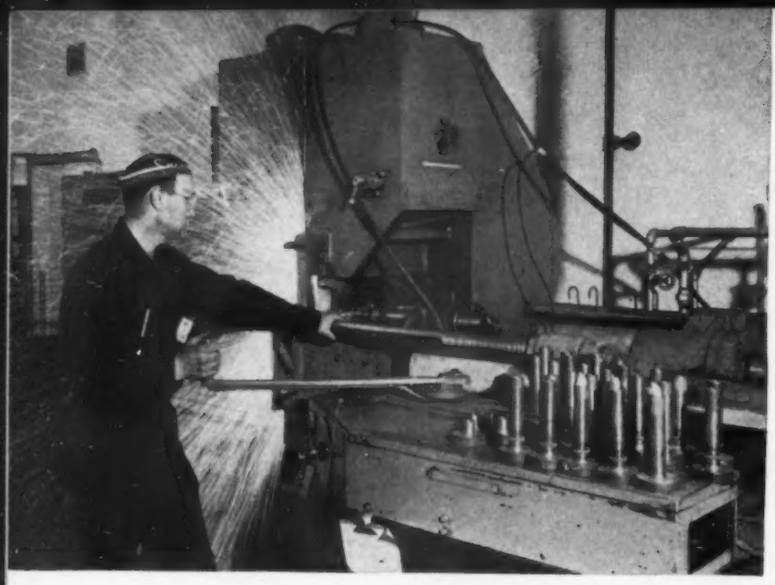


Fig. 1—Welding piston heads to piston rods saves material and machining time

FLASH WELDING IS VERSATILE

BY C. B. SMITH
WELDING ENGINEER, DOUGLAS AIRCRAFT COMPANY

This process is often justified on limited quantities by savings in materials and subsequent machining

FLASH BUTT, or flash welding is an electric-resistance welding process whereby a butt weld is made between two similarly shaped sections. The heated ends are forged together after an initial heating period, during which some of the metal is expelled as molten particles or flashed from the weld area in the characteristic manner giving the process its name.

The process has had numerous applications on a wide variety of metals, shapes and sizes of joints. It has been used in continuous-strip mills and wire-drawing plants where a strong butt joint is essential. It has found application in window sash, furniture, chain—including ship anchor chain—toys, automobile bodies, frames, axle housings, tire rims, barrels, oil-well drill-pipe joints, electric motor frames, airplane control rods, motor-mount members, landing-gear members, hydraulic system components, and for such familiar toolroom items as bandsaw blades and drill shanks. Fig. 2 shows the "before" and "after" condition of several typical aircraft parts.

The strength of flashwelded joints can equal that of the unwelded material, provided all the precepts for good flash-welding design are observed. In many automobile applications, and in most aircraft applications, joints of maximum efficiency are required. However, adequate strength for certain applications can be obtained even though ideal conditions for welding are not maintained. Two examples of this latter case are miter joints in window sash, and joints frequently found in toys, where the sections joined are not the same shape or size.

As considerable time, frequently more than an hour, is required to change from one setup to another, enough welding should be performed in each setup to absorb the setup time. In the automobile and the war-

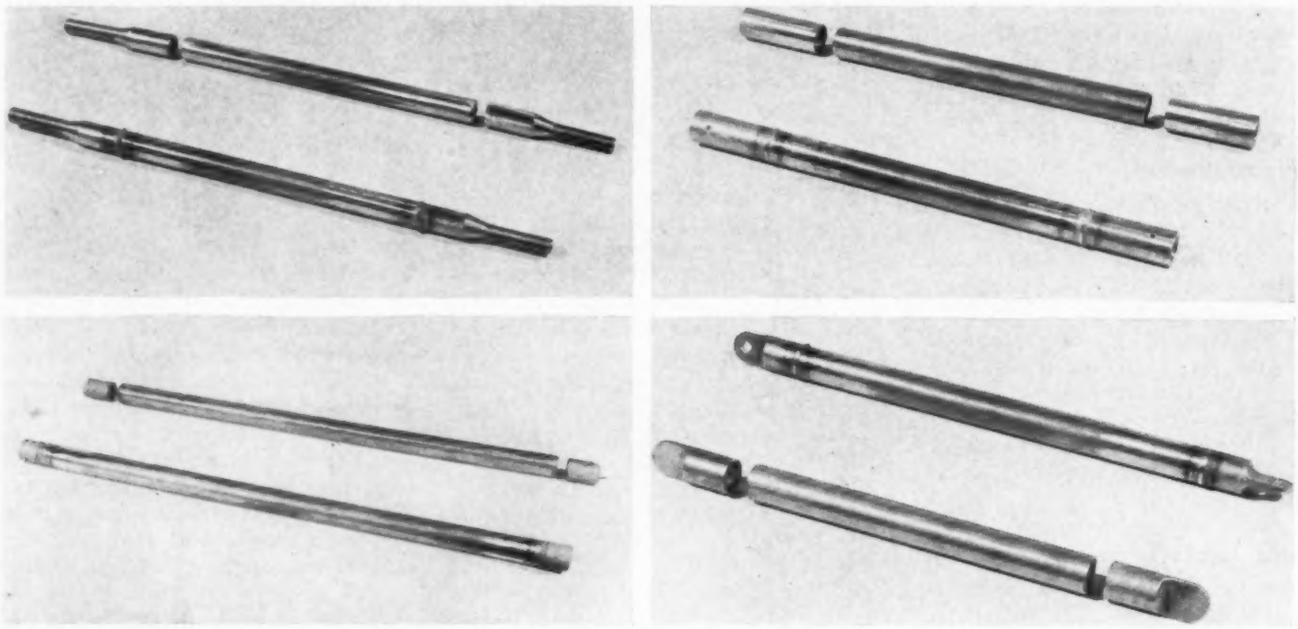


Fig. 2—A variety of aircraft rods lends itself to flash welding: (upper left) A control rod has threaded ends for length adjustment; (lower left) This control rod has length adjustment through internally threaded ends; (upper right) Proper angular relationship of the ends of this strut is maintained by welding fixtures, and holes are drilled after welding for accurate spacing; (lower right) Close tolerances on the blank ends of this strut are held by finish machining after welding

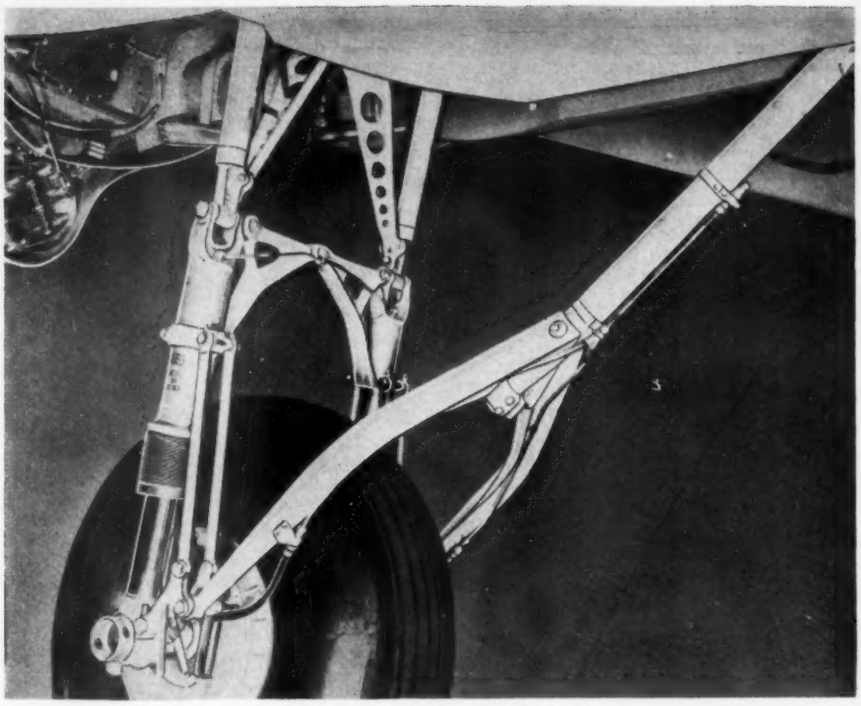


Fig. 3—Seven flash-welded members are used per main wheel of this landing gear

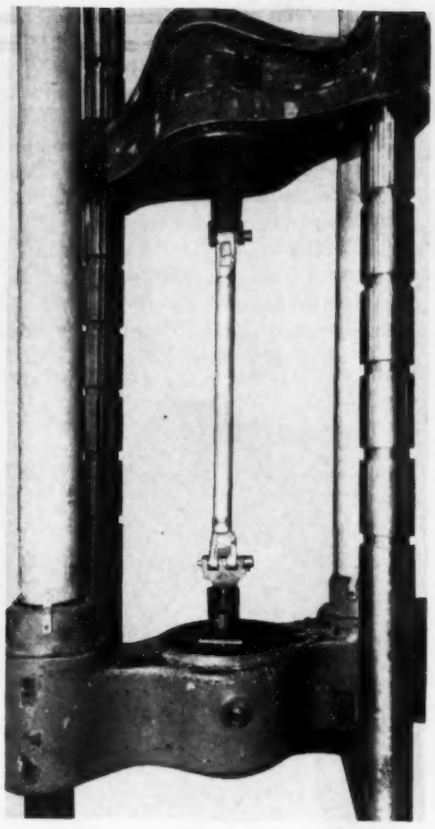


Fig. 4—Side members of the landing gear are proof-tested in this setup

time aircraft industries, the quantities are enough to absorb the setup time readily. It remains, therefore, to justify the use of flash welding for small lots of parts manufactured on a competitive basis.

Three important considerations tend to justify the use of flash welding on assemblies where the quantities involved are low:

1. A saving in weight.
2. A saving in costly materials.
3. A saving in manufacturing costs.

Weight saving interests public carriers, where each pound saved on the equipment may be turned into pay load. Aircraft operators pay considerable engineering attention to this one item. In aircraft, the engine mounts and the landing gear are subjected to the greatest stresses; consequently, materials with high strength as compared with weight are desirable for these applications.

Alloy steels, heat-treated to high tensile strengths, are usually used. Assemblies must be broken down into comparatively small, simple components for heat-treatment, with final machining usually performed later to compensate for shrinkage or warpage. Steels which can be heat-treated to high values generally are difficult to weld with arc or gas, but may be readily welded by flash welding. The flash-welded joint is a butt joint, while for structural applications with arc or gas, a lap or fish-mouth joint would be required.

An increase in section by 20% is required when arc or gas is used to compensate for the cast structure of the weld, but as a flash weld is a wrought structure, a comparable weld depreciation factor is not required. These items, combined, add up to enough saving in weight to justify the use of the process, even though the number of parts is low.

An aicraft landing gear, Fig. 3,

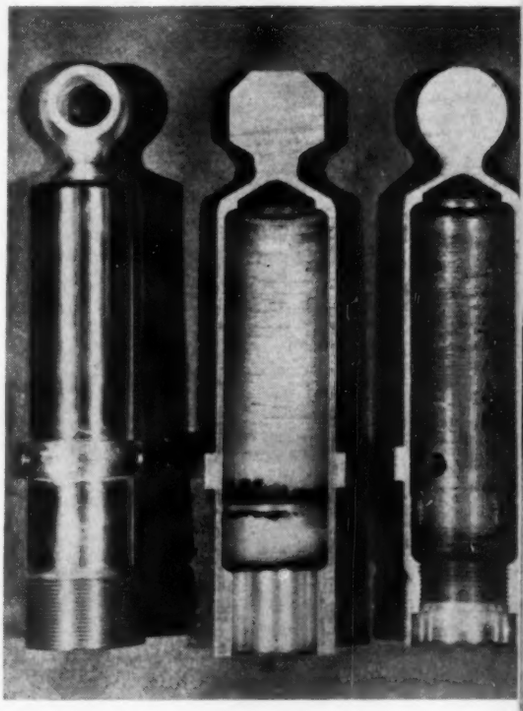


Fig. 5—The internal shape of this hydraulic piston requires a difficult boring operation if one-piece construction is used

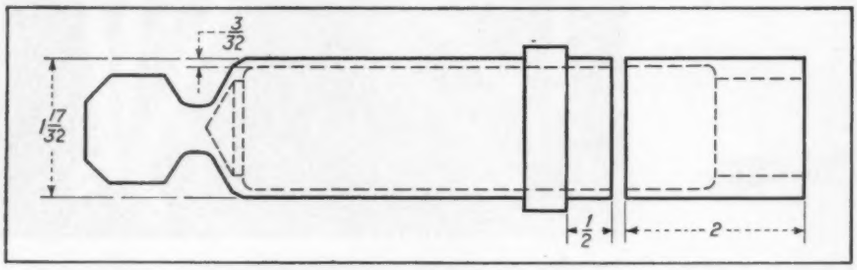


Fig. 6—The use of two pieces prior to welding for the hydraulic piston simplifies boring

contains seven members fabricated by flash welding. One of the members of the landing gear installed in the fixture, Fig. 4, is used for checking weld quality by a tension proofload.

The saving of costly materials arises through the ability of flash welding to unite metals of vastly different metallurgical characteristics. Thus, automobile valve heads which must withstand high temperatures may be welded to shanks made from inexpensive material. A similar condition exists in gas turbines where the hub, made from a special alloy, is welded to the shaft of regular alloy steel.

The saving in manufacturing costs in low-quantity production results primarily from a saving in machine-shop time, because of more economical production design. Piston rods being welded to piston heads, Fig. 1, exemplifies one method of saving. Here, the piston head was machined from a short length of solid bar, and the piston rod was made by cutting off a length of heavy-walled tubing. The piston assembly formed by welding requires comparatively little machining for final finishing.

Another part, Fig. 5, also a piston, gives a saving from an entirely different standpoint. When this part was made from a solid piece, a rather nasty job of boring was involved. By making the part from two pieces, Fig. 6, the boring operation is sufficiently simplified to more than compensate for the flash welding.

A bellcrank used in the retracting mechanism of an aircraft landing gear, Fig. 7, would be impractical to make from one piece. Other methods of welding would fail to provide the necessary strength without considerable increase in weight. This part is made from two forgings and a short piece of tubing, joined with two welds. Considerable machining time and weight is saved through this method of fabrication. If only one weld were used, eliminating the tubing, the large ends of the forgings would have to be made much larger to provide the extra length, because of draft angle requirements. A part made from three forgings, Fig. 8, would be extremely difficult to forge in one piece, or to fabricate by other methods, without greatly increasing the weight or time required.

During the war, several other aircraft flash-welding applications were used. In one instance, the source of regular half-ring forgings used in an engine mount was inadequate to meet production line requirements. The only available sources could not handle forgings of sufficient size. Accordingly, the part was cut into quarter segments, and the quarters flash welded together to form halves, which could then be finish-machined in the regular tooling. The welded half-ring is tested in a fixture, Fig. 10, for weld quality by a combination of

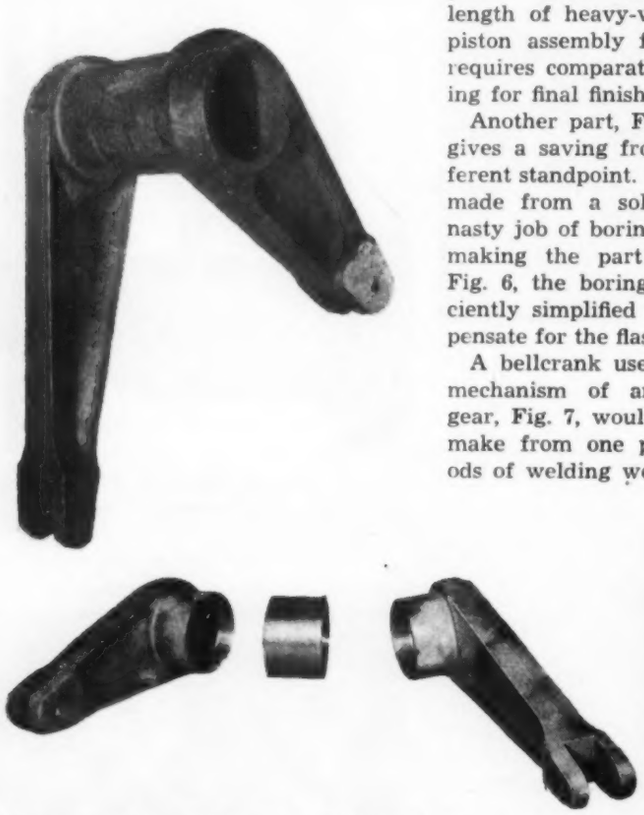


Fig. 7 — This landing-gear bellcrank is made by flash-welding two arms and a hub

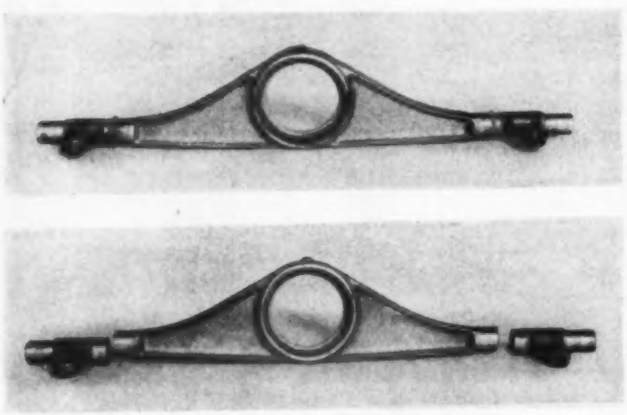


Fig. 8—The landing-gear cross beam would be impractical to forge in one piece so the ends are welded on. Final machining is done after welding and heat-treatment

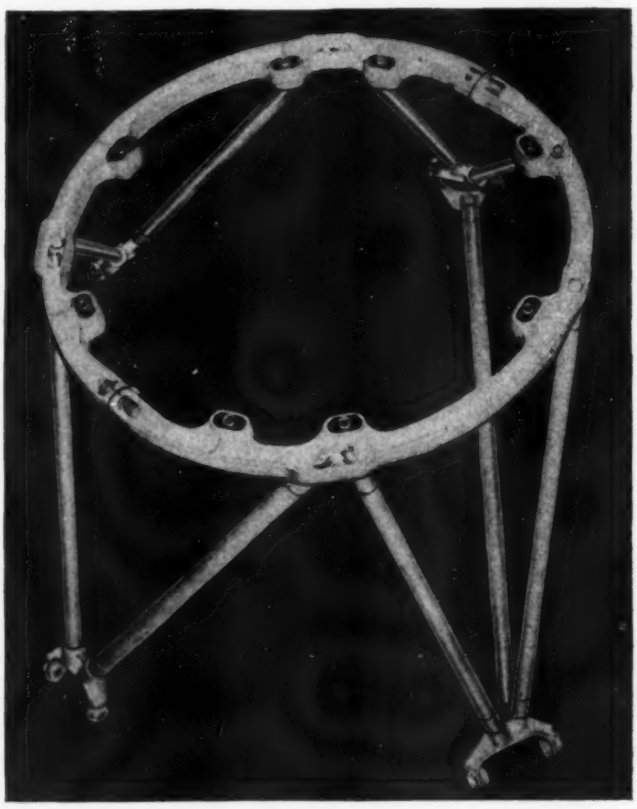


Fig. 9—This bolted engine mount regularly used the struts, Fig. 2, and frequently the welded half rings, Fig. 10

Fig. 11—Typical automotive practice is used to weld two pressings to form the bracket assembly

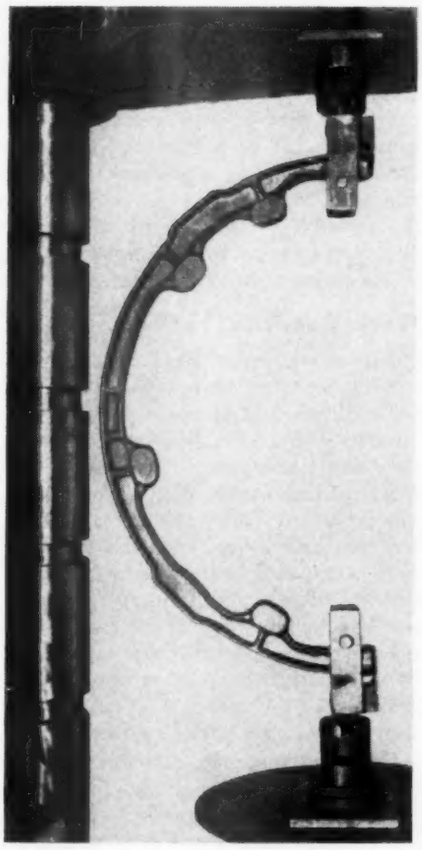


Fig. 10—Weld quality of the engine-mount half ring is checked in a proof-testing machine by a combination of tension and bending

tension and bending. The completed engine mount, made from the regular half-ring forgings, Fig. 9, has the flash-welded tubular struts bolted into place.

In another instance, a shortage of skilled arc-weld personnel forced a design change in brake torque-axle assembly. The resulting flash-welded part, Fig. 12, is a flat plate formed so a short tube section projected from it. A piece of heavy-walled tubing was then flash welded to it, resulting in the blank from which the final axle was machined.

Frequent emergency requests for modification of equipment are typified by a glider-tow attachment assembly, Fig. 13. This assembly utilized four identical flash-welded struts. Flash welding was chosen for this application because it could be placed into production rapidly, and still give a high-quality lightweight product.

An application of flash welding in aircraft which would have been more typical of the automotive industry was a bracket, Fig. 11. This is composed of two mating channel sections flash welded together to form a box section. In this case, there was a total of 22 linear inches of weld in 5/31-in. thick mild steel. Although the usual aircraft construction would have been to machine this part from a forging, procurement time did not permit that method of manufacture.

The author expresses his appreciation to E. S. Waldbott, process engineer and chief metallurgist, J. C. Bonser, quality manager and Wilson Silsby, manager of public relations, for releasing this article.

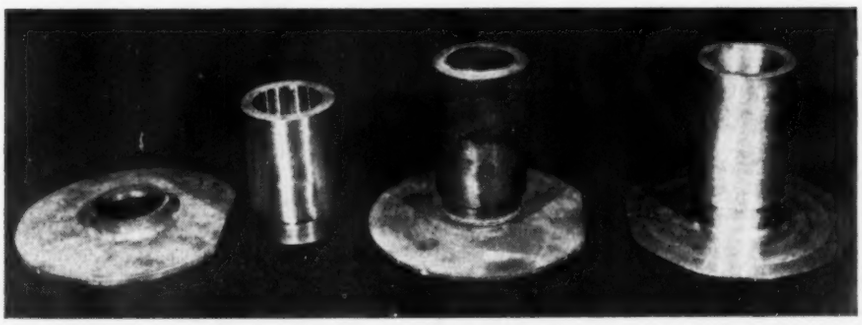


Fig. 12—The brake torque axle is made by flash welding a tube to a plate

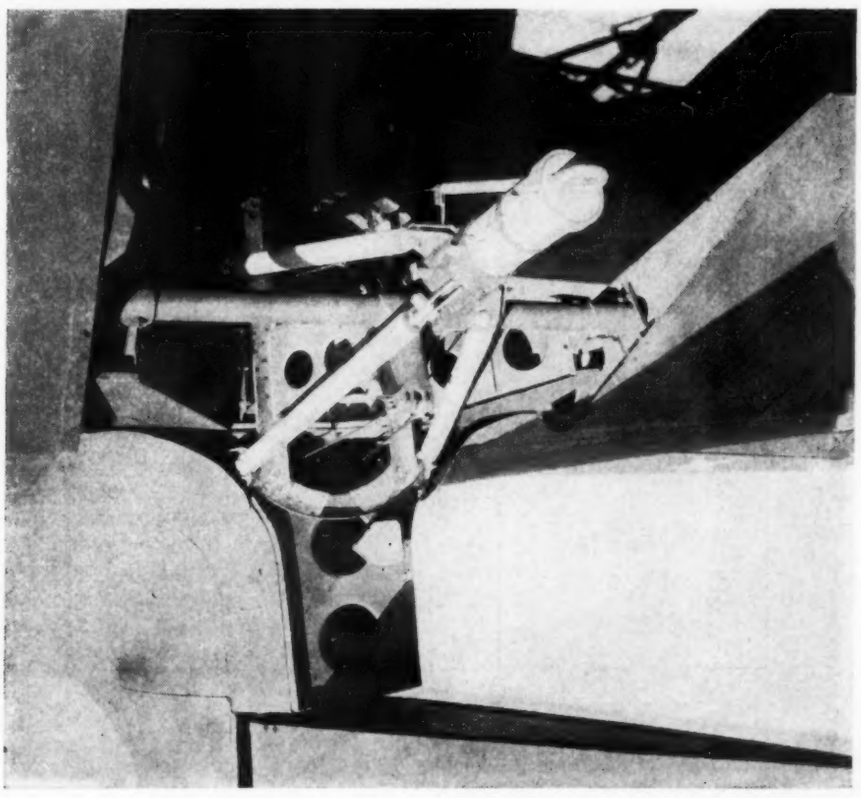


Fig. 13—Four flash welded struts are part of the glider tow assembly

Effort Can Be Measured

A standard day's work can be established by time study if job effort is measured accurately and standards are consistent

BY RALPH M. BARNES

PROFESSOR OF INDUSTRIAL ENGINEERING, AND DIRECTOR OF PERSONNEL, UNIVERSITY OF IOWA

MOST OF US believe that we can and will have a gradually increasing standard of living. We want more and better things at the lowest possible cost, but to get them we must have greater productivity per manhour.

This does not mean that people will have to work harder physically. It does mean that management and labor both will have to use their ingenuity and inventive ability to develop better work methods, perfect better equipment, and improve the design of products to reduce the number of manhours required to make the product.

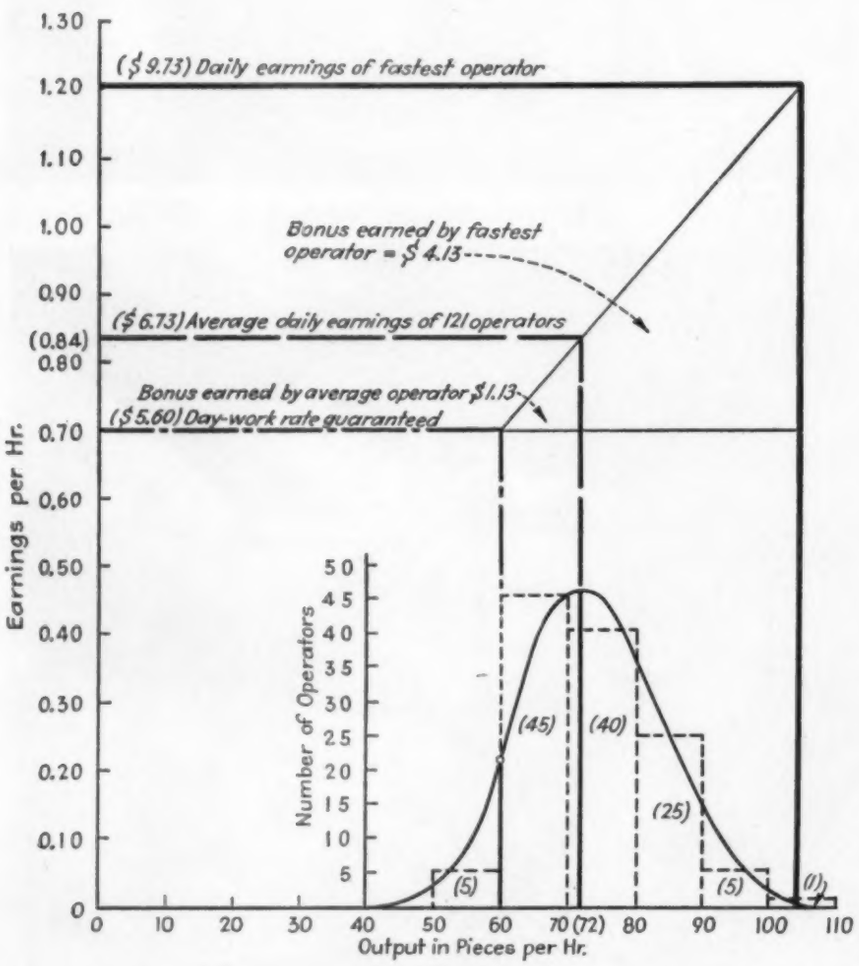
Moreover, it will require that every worker apply himself to his job during every hour of the working day. No employer that I know of expects his employees to work inordinately hard, but he does expect a standard day's work for the wages he pays.

Stopwatch time study answers the question, "What is a standard day's work?". Because hourly wages have increased so much in recent years, many people believe that the time has come to measure all manual work in the factory, whether or not an incentive system of wage payment is used. Both the employer and the worker on the job should know what the standard day's work is, and both should know each day whether or not the standard has been met.

One of the most important and most difficult parts of time study is that of determining the speed, or effort, at which the person is working when the study is being made. This is commonly referred to as *effort rating.*

During recent years I have been conducting a series of work-measurement experiments to determine the ability of men to rate effort and to find ways to improve the accuracy and consistency in time-study work. There is considerable evidence to show that, with proper training, marked improvement can be made in effort rating and that few indeed are the men who cannot be trained to do satisfactory work in this field.

Some people would have us believe that all people produce about the same amount of work per day, and that if a wage is established for the average person, no individual will be greatly underpaid or overpaid. But there seems to be plenty of evidence to disprove this statement.



This distribution and earnings curve for 121 semi-automatic lathe operators shows an average output of 72 pieces per hr. and average earnings of $6.73 per day, 20% above the standard rate

Work Capacity Varies

From our own observations and experiences, we know that there are wide differences in the capacities and abilities of individuals. If we eliminate the rare exceptions, the range of most physical and mental activities varies two to one, that is, the best has approximately twice the capacity of the poorest. If the production record in pieces per hour is compiled for any large group of people working on the same manual operation, it is usually found that there is a wide spread between the outputs of the slowest and fastest operators.

The accompanying distribution and earnings curve shows such a record for one day for 121 semi-automatic lathe operators performing identical work. The bell-shaped curve shows the distribution. For example, the average output of the five poorest operators was 55 pieces per hr., where-

as the output of the very fastest operator was 104 pieces per hr. The time standard for this operation, as established by time study in the factory, is 60 pieces per hr.

If the rate, or the guaranteed hourly rate, is taken as $0.70 per hr., the operator who produced 60 pieces per hr. during the 8-hr. day would receive $5.60. The average output for the group was 72 pieces per hr., which is 20% above the standard. At this level of output the operator earned $6.73 per day. The one operator who produced 104 pieces per hr. earned $9.73 per day. Her efficiency was $104 \div 60 \times 100 = 173\%$.

As in many factories and shops, only one, or at the most, a few operators will work on the same job, the performance level of the operator might be that of the very slowest or fastest person, or somewhere in between. It is obvious that the time taken by the operator to do the job is no indication of the time it should take a person working at a normal pace to do the job. It is necessary, therefore, to determine the rate of speed, or the effort exhibited, when the time study is made in order to establish a normal time for the job.

As effort rating depends entirely on the judgment of the time-study men, the question naturally arises regarding their ability to rate accurately and consistently. Although there is only a limited amount of reliable data available on this subject, it seems that a group of competent, well-trained, time-study men can set time standards, no one of which will vary more than plus or minus 5 to 7% from the average of the group.

Many companies throughout the country are taking steps to improve the accuracy and consistency of the time standards set by their time-study men. In some places this consists of a one- or two-hr. conference once a week. Other organizations hold one- or two-day sessions each month. The short weekly session may consist of practice in effort rating of such operations as walking, card dealing, block tossing and typical factory jobs, or the rating of motion pictures of actual factory operations. Also, simultaneous time studies may be made by all time-study men of factory or office jobs.

Standard Performance

There is evidence to show that "standard performance," or "normal effort," is not the same in all plants. Employees in some plants are expected to work at a faster pace than in other plants.

We have been studying the problem of work measurement for several years and have obtained data which substantiates the above statement. Among other things we made a sound motion picture of a typical drillpress operation. The film contains an introductory explanation of the job and then shows twelve consecutive cycles of the operation.

It has been shown to experienced industrial engineers from many different plants. These engineers have made a complete time study of the job, computing the standard time in minutes per piece. We find that there is considerable variation in the standards. For example, one company in the east made a survey, using this sound film, in its 16 factories.

This company found the highest time standard to be 29% above the lowest. If this is an accurate measure of conditions as they actually exist, the manager of the plant with the fastest tempo is requiring his employees to do 29% more work for normal performance than the manager of the plant working at the slowest tempo.

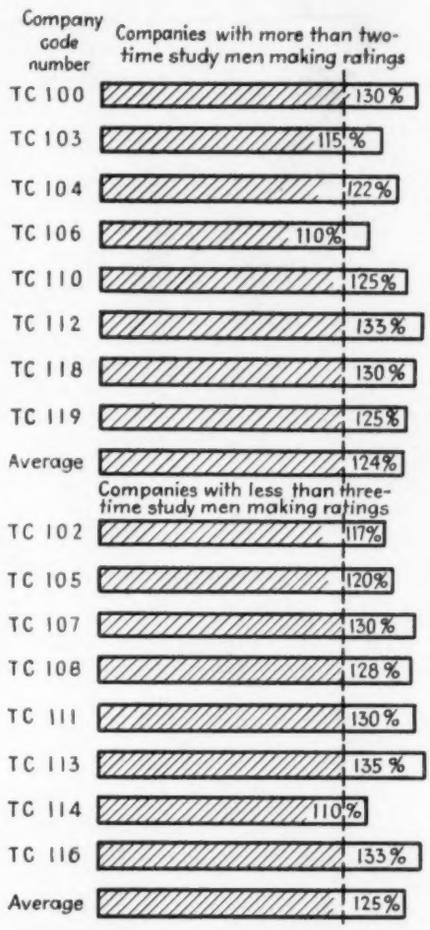
Many companies with two or more plants are taking steps to standardize a normal performance for their organization and are training all of their time-study men to set consistent time standards keyed to this normal.

Midwest Survey

On April 23, 1946, I assisted in conducting such a time-study survey in a midwestern industrial area. Seventeen companies participated in the survey with over 50 time-study men present at the meeting. Motion pictures were shown of 13 different operations, most of which were actual factory jobs. Each person rated each operation in percent, and company composite ratings were submitted under code numbers. Results ranged from 110 to 135%, averaging 125% on the tube-bending operation. It is interesting to note that on this film the average rating made by engineers from 137 different plants throughout the United States and Canada is 132%.

I believe that it is just as important for the plant manager to know how his company stands with regard to the performance level of his employees as it is to know how his hourly base rates compare with those of other plants in the community. Just as we do not expect all plants to pay the same base rate in a community, so it is not advocated that all plants have the same performance level.

RESULTS OF A TIME-STUDY SURVEY
OPERATION: BEND COPPER TUBING FOR OIL LINE OF TRACTOR ENGINE
Date of Study: April 23, 1946



Results of the survey show that standard performance varies from plant to plant. Companies TC-106 and TC-114 rated the operator at 110% whereas TC-113 rated him at 135%. The average for all companies was 125%

We need a national and international standard day's work. Our first job, however, is to see that all time-study men in a plant set accurate and consistent time standards. If the company operates more than one plant, it is desirable that the time-study procedure be standardized for all plants and that time-study men in all plants be trained "to see alike" in setting their time standards. In addition to this, I believe that many communities might profitably conduct time-study surveys and that every company should give its support to the movement to establish a national and international standard day's work.

ROUND TABLE

Old Man Jonas Looks On --And Doesn't Like It

"Why the frown, Ed? You look like you have to make a one-man decision on the atomic bomb. Worrying again about inflation?"

"No, Al, I've just been talkin' to Old Man Jonas, over at the pump works, and some of the things he told me set me to thinkin' and wonderin'. You know, he's just sittin' and waitin' the year out, while young Tom Foster has taken over as supe."

"Well, it's about time, isn't it? Jonas has been running that show for 25 years or more and he's due to retire. They'd better get somebody trained while they've still got Jonas to steer 'em."

"Maybe, so, but Jonas says they ain't listenin' to him—just let him set there and tell him nothin'."

"Sounds like he's a little itched because they aren't running into trouble without him, Ed."

"But they are—or so Jonas says. He says their costs are goin' all out of line—and they don't know what to do. Says Foster and his boys just sit up in the office, having one conference after another. He says he can't figure out what they can find to have so many conferences over—never needed 'em before."

"Maybe they're trying to be a little more human than old Jonas was. He always seemed to me to be quite a dictator, Ed—ran everything to suit himself. The only thing that saved his hide was that the old-timers used to quiet down the younger soreheads. Besides, Jonas knew so much you had to give him credit."

"He does that, Al. And he did know what was going on all the time. He got work out of men for what they got paid, but he set the example by workin' harder than any of 'em."

"There's those who say, Ed, that a good executive should be able to get others to do the work, and spend his time planning and taking care of trouble. Tom Foster seems to me to know what's going on and why."

"Everywhere but in the shop, Al. He must think he's better than the men. He's lost their confidence —that's why they had that strike a while back. They don't know him and respect him like they did Jonas."

"I'm not sure that was the reason for the strike, Ed. After all, times are changing, and Jonas might have had to face a strike just like they had to."

"I don't think he would. After all, he never did have one. And everybody understood his ways and his methods. He didn't have half a dozen silly college boys setting rate, for one thing—kids who don't know when a man is soldierin' to get a good rate."

"Oh, so the men are playing crooked too, eh? At least, according to Old Man Jonas they are. Sounds like he thinks he was a better detective too."

"No, Al, he just knew all the jobs—and what they ought to pay. He didn't need a lot of high-priced help to run a shop, help that raises costs all along the line."

***IS THE TREND** of management away from intimate contact with the shop? Is the race of executives who worked their way up being succeeded by men with college degrees but no grease on their hands? Are we becoming over-methodical? Your opinions and experiences will be of help to others.*

Lighting FOR PRODUCTION

BY HARRY J. WILLIAMS
ASSOCIATE EDITOR

Industrial lighting is forging ahead to new levels of achievement. The advantages of modern-day lighting in metalworking plants are manifold — providing the installation delivers the engineering efficiency to meet specific seeing tasks. Good lighting isn't just a matter of surrounding a light source with a fixture. It demands careful analysis of the various seeing tasks involved, with *quality* of light receiving consideration equal to that of the quantity of light. Footcandle levels have increased substantially in recent years because lighting is recognized as an accepted production tool. The cost of good lighting must be balanced against the over-all savings that such a system can reap through increased production, improved working conditions, reduced accident frequency and severity.

★ AN American Machinist REPORT TO THE METALWORKING INDUSTRIES ★

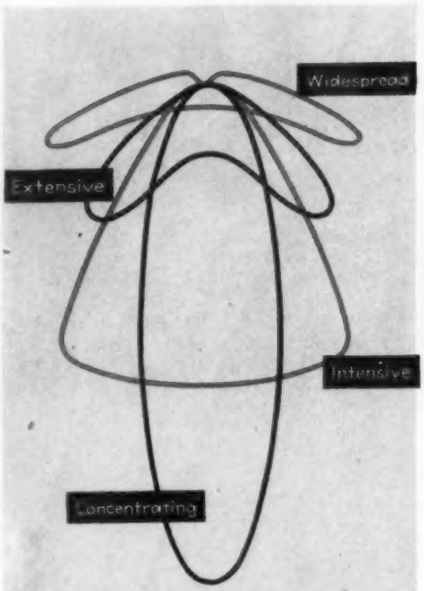
AS a production tool, artificial lighting can be good, bad or indifferent. There can be little argument with the universal claim that lighting, conforming to sound engineering practice, increases production directly and indirectly.

Metalworking plants, by the very nature of the varying and multiple machining operations performed on a wide range of materials, have distinct lighting requirements. This is generally known, but its acceptance from the standpoint of present-day installations leaves much to be desired.

The relentless pace of war production did much to focus attention on the importance of artificial illumination as a production medium. Blacked-out and windowless plants left no alternative to providing adequate light from electrical sources. 'Round-the-clock operations emphasized the necessity of lighting systems that gave sufficient light for visual tasks ranging from rough machining to the closest inspection of precision parts.

Fluorescent lighting really caught hold and almost overnight won a substantial and permanent place in the field of industrial illuminants. As a matter-of-fact, the insatiable demand for fluorescent installations during war-production years forced manufacturers to work at top speed to keep pace. Little time could be spared for any developments that were not predetermined contributions to the war effort.

Windowless plants springing up during the war years were naturals for fluorescent lighting, for its reduction of heat emission served a practical purpose in relieving air-conditioning units from the added task of compensating for heat from light sources.



Controlled light distribution has its basis in these four types

The general acceptance of fluorescent lighting in the five war years has virtually revolutionized the field of industrial light. There is no intention here to draw a fine-line comparison between incandescent, high-intensity mercury vapor, or fluorescent units for industrial lighting because user preference in these immediate postwar years will present an unalterable distinction.

It would be foolhardy, however, to minimize the probability that fluorescent lighting will achieve top industrial position in the years ahead, possibly relegating incandescent sources to more specialized applications. This is assuming, of course, that industrialists will continue to demonstrate their interest in the value of good, uniform lighting as they contemplate relighting present manufacturing plants and the illumination of new plants.

Incandescence versus fluorescence is rampant with controversial issues. But men who have devoted many years to the subject of lighting seem to agree that fluorescent lighting will predominate much more quickly under the impetus of war experience than might have been true in normal times. Furthermore, the present and future endeavor in research, refinement and development can lead only to improved fluorescent lighting practice.

Lighting Progress

Basically, lighting is a seeing aid. Fire first was used by man for light long before it was used for heating or cooking. Crude torches were the first portable lighting means. Early developments led to the pottery lamp, the tallow candle, the open-flame gas burner, the coal oil lamp and the Welsbach mantle — each providing ever-better seeing conditions.

Then came the incandescent lamp, representing a gigantic stride in artificial illumination. The outstanding progress of incandescent lighting and its universal acceptance need no reviewing. Its contribution to easy seeing and eye comfort defies measurement. Principles developed for incandescent lighting will stand up for generations to come. The tremendous volumes of research accomplished serve today and will serve in the future as invaluable aids to lighting progress.

Good seeing conditions are a prime consideration in metalworking shops. The trend today emphasizes reduced brightness contrasts and there is a definite move away from mere foot-candle designing. Effective light control with the accent on quality is the byword of planned lighting systems. This thinking redounds to the benefit

Grid systems of fluorescent lighting are most effective in minimizing shadows, providing a greater vertical component of illumination in all directions, and in affording adequate light for dials. The continuous rows of fluorescent light are crossed by individual fixtures forming the grid pattern. Note also that machine tools have been painted in lighter colors for greater reflection values

of production-wise managements.

Employees have become more and more conscious of their right to work under conditions favorable to their health, safety and comfort. Much has been written on the importance of preserving eyesight. Dr. Matthew Luckeish, noted for research in the science of seeing, states:

"Seeing is a complex activity of the entire human being. The tools used are light and sight, but the entire human being is involved as a human seeing-machine. Muscular, neural and mental energies and strains and fatigues are involved. The cutting tool of a lathe apparently does the work but actually the strains are imparted to every part of the machine."

War-Taught Lessons

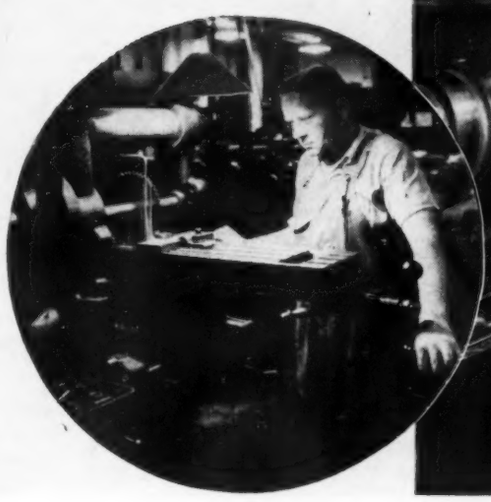
In this connection, the war production years gave many vivid examples of how improved lighting increased worker efficiency. The demand for older workers to fill wide gaps in production lines drained by the armed forces compelled evaluation of industrial lighting installations. The production experience of older men was put to its best use when they were assigned to responsible jobs. As eyes grow older there is a progressive loss in visual acuity; defects in vision increase markedly. Eyeglasses aid, naturally, but it was determined that suitable illumination is an effective aid for older workmen in performing exacting work.

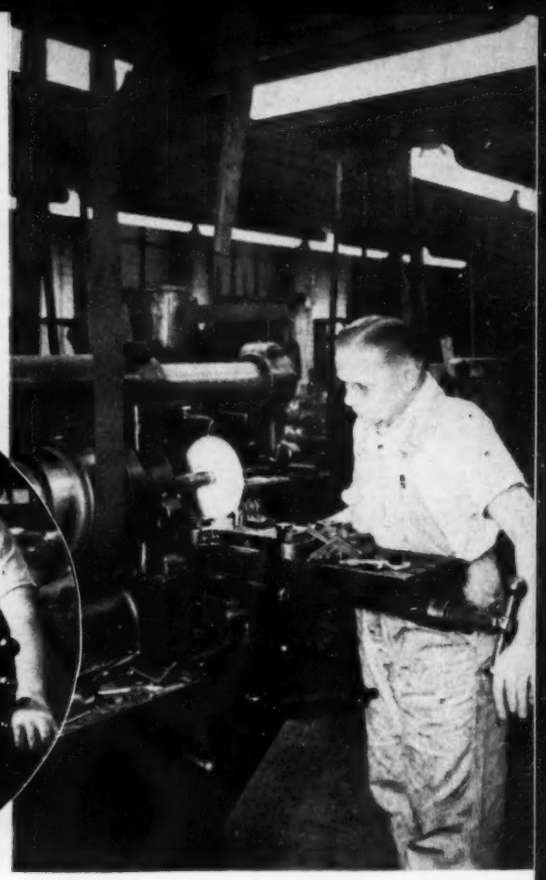
Illumination for Safety

Lighting as a safety factor in industrial plants is tangible. It is a major cog in machinery designed for safe plant operation. A review of plant accidents shows that many involve a combination of personal and mechanical causes. Too often, poor illumination has been overlooked as a contributing cause. Many accidents laid at the door of machines might have been averted if the task had been lighted sufficiently for the victim to see quickly and accurately.

Perhaps an exposed light bulb some

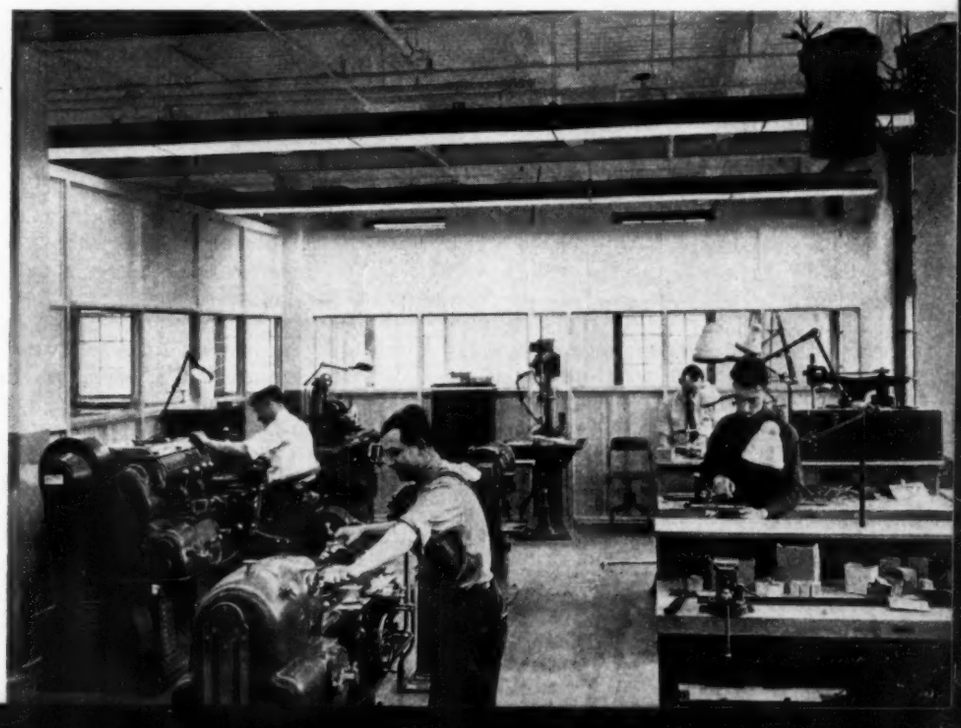
Glare is the insidious gremlin who takes a toll on the eyes of workers with consequent losses in production. The poor local lighting fixture (below) permits light to enter directly into the operator's line of vision. A new installation (right) removes the glare source and provides adequate general lighting for the seeing task





REQUIREMENTS OF GOOD ILLUMINATION

1. There must be an adequate level of illumination.
2. The light must be properly diffused, directed and distributed.
3. Harsh, dense shadows should be avoided.
4. Glare should be minimized.
5. The light should be steady and free from objectionable variations.
6. Maintenance schedules should be maintained consistently.
7. Cleanliness and painting of interiors, including machinery, in functional colors, contribute to good lighting.



Worker morale is bound to be given a lift when working areas are well lighted and cheerful. Improved working conditions are demanded today by labor and good lighting conditions are high on the list. This shop benefits from the fluorescent lighting installation combined with well-engineered local lighting for visual tasks requiring a high measure and quality of illumination. Glare is held to a minimum

LIGHTING TERMS

Candlepower—Luminuous intensity of light sources. The use of candle in the definition of light units stems from measurements taken when newer light sources began to replace the candle. A candlepower measurement specifies the luminous intensity of any light source in a given direction and represents the light density in that direction. The candlepower measured in one direction, however, is no indication of the total amount of light produced by the illuminant.

Lumens—The light output of practically all lamps or light sources used for lighting seeing tasks is expressed in terms of lumens. It may be defined as the amount of light falling on a surface 1 sq. ft. in area, every point of which is 1 ft. from a uniform source of one candlepower. The light output of a 100-watt tungsten-filament lamp, for instance, is 1,600 lumens—or 1,600 units of luminous flux. The output of a 40-watt white (fluorescent) lamp is 2,300 lumens. A 500-watt filament lamp has a luminous flux output of 10,000 lumens while a 3,000-watt mercury lamp emits 120,000 lumens.

Brightness—An expression of luminous intensity. To be seen, an object must be luminous—whether it reflects light or emits it. It is by reason of light emitted, reflected, or transmitted that a surface appears bright.

Footlamberts—The modern unit of brightness. If a surface emits or reflects light at the rate of 100 lumens per sq. ft., the brightness of the surface is 100 footlamberts. The brightness of a body emitting or reflecting light diffusely at the rate of one lumen per sq. ft. is one footlambert. The brightness of the 100-watt filament lamp is over 50,000 footlamberts; the brightness of a 40-watt white fluorescent lamp is about 1,750 footlamberts.

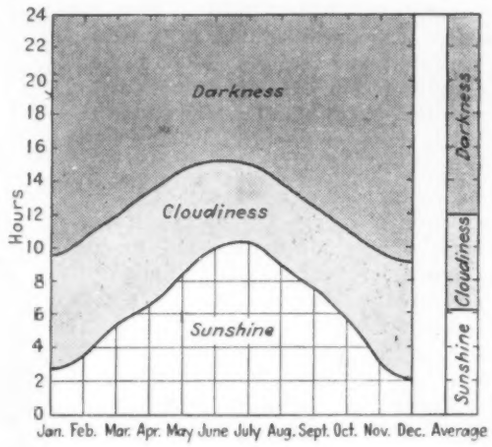
Volt—Unit of electrical pressure corresponding to psi. of water pressure. One volt is the electrical pressure or electromotive force generated by a standard cell or battery constructed in a standardized way of carefully specified materials.

Ampere—The electrical unit of current flow corresponding to cfm. or gpm. for water flow. Technically, it is the unvarying rate of current flow which will deposit 0.001118 grams of silver per sec. from a standard silver nitrate solution.

Watt—The electrical unit of power corresponding to horsepower. It is the product of volts x amperes (pressure x quantity per second) and represents the rate of doing work. One horsepower is equivalent to 746 watts. A kilowatt is 1,000 watts.

Watthour—The electrical unit of work. It is the product of volts x amperes x time. It is the rate of doing work multiplied by the time during which this work is being done.

Natural daylight is far from adequate for meeting the lighting needs of metalworking plants throughout the year. This chart demonstrates how little actual daylight is available over a considerable period of the year



distance away caused an element of glare which even the worker wouldn't blame as responsible for his slow reaction in preventing a mishap. Glare is either directly caused by light sources in the line of vision, or indirectly caused by reflection from highly polished or light-colored surfaces. It results in difficult seeing and is an important cause of industrial accidents. The condition of illumination at the accident point and in the surrounding area should always be inspected and considered in accident investigations.

Research over the years leaves no doubt that fatigue is one of the most common causes of accidents, and fatigue is often attributed to eye-strain. A tired worker becomes less careful, and body reflexes slow up noticeably.

Worker Morale Boosted

Well-lighted plants have a beneficial psychological effect on workers. No one enjoys working in gloomy, dingy surroundings. They lead to irritability. Case histories taken before and after new lighting installations bear out the fact that worker morale gets a definite lift. There is insufficient space here to cite case histories, but the following statement by a machine tool manufacturer is typical:

"Now possible to do extremely fine work for longer periods. Possible to set up very accurate jobs more rapidly. Precision machinery and tools can be used anywhere in shop. No lost time in going to window light to read micrometers."

The last sentence about going to windows for more light to read micrometers recalls a familiar sight in machine shops through the years. A good artificial lighting system with all variables taken into consideration can overcome the necessity of going to windows.

Daylight is inadequate for the demands of industry. Weather and seasonal variations in daylight illumination compel the eyes of workers to compensate for brightness and color changes. Daylight does not penetrate many buildings in sufficient quantity to permit work of an exacting character to be performed 15 to 20 feet away from windows.

Watch Those Windows

Arrangement of machines with reference to vertical windows requires planning. If workers are facing large, bright window areas, it will prove to be as glaring and uncomfortable as having bright lamps in their line of vision. Conditions are made much more trying for operators because the interior light is much lower and in sharp contrast to brightness at windows.

If machines are arranged so operators do not face the windows, the improvement in working conditions is obvious. If the plant layout does not permit rearrangement, it is advisable to shade or paint out the windows and increase the level of artificial lighting.

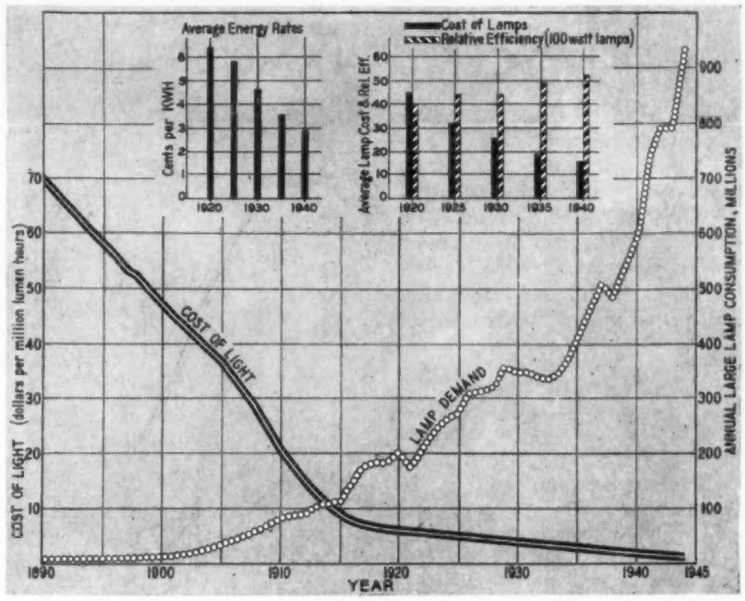
With peacetime production soaring to new heights, those engaged in metalworking can ill afford production errors, inaccuracies and poor work. Like keen-edged tools and precision gages, good lighting contributes to better craftsmanship. Adequate light improves worker alertness and helps spot errors in work before large runs are ruined.

An increase in illumination from

one footcandle to a moderate level of approximately 20 footcandles results in increasing the speed of seeing about three times. This enormous improvement in perception and recognition of surroundings affects virtually everything the workman does. Split-second seeing is an important aspect of accident prevention.

Higher levels of illumination can be expected as the field of industrial lighting advances. Lighting levels are likely to reach 100 footcandles or even higher for general illumination. While some experts predict general-lighting levels of 150 footcandles, they qualify their statements by explaining that quality of lighting must keep pace. Local lighting will undoubtedly have a marked effect on increasing lighting intensities.

A uniform level of general lighting makes possible the most efficient arrangement of machinery and conveyors, and better utilization of floor space. Straight-line-production flow is often defeated by the necessity of placing certain departments near windows for better light. Yet modern lighting permits uniform working light in all sections so work can flow in straight lines through assembly or inspection sections.



Lamp usage and cost of light has shown a steady decrease during the past five decades. Lighting costs have lowered because average electric energy rates have been reduced, the average lamp cost is now only 40 percent of the 1920 average cost, and lamp efficiency has been boosted. The average cost of light per million lumen-hours has been reduced from $70.80 in 1890 to about $1.35 today

Painting as an Aid

While the maintenance of lighting equipment is essential to getting the most out of a system, attention to the room itself and its part in the lighting program is important. Frequent cleaning and painting of walls, ceilings and flooring can be of considerable help in the over-all results of illumination.

Application of functional colors to the walls, ceilings, pillars and even machinery itself combines with lighting to make a more favorable working atmosphere in industrial interiors. Reflectance factors of these surfaces and contributions in contrast at critical working points go hand-in-hand with modern lighting to improve working conditions. A special report on "How To Use COLOR In The Shop," in *American Machinist* recently pointed out the part paint can play in improving the visibility of workers.

The lighting of metalworking shops to adequate standards should not be attempted by hit-and-miss calculations. Most electric power and light companies have lighting service departments equipped to analyze situations requiring planned lighting. Where plans are underway for new buildings, such departments can merge lighting considerations with structural plans for effective illumination. In relighting industrial plants, they are qualified to determine the adequacy of present wiring and outlets, the types of lighting sources for specific purposes, areas requiring supplemental lighting, and machine operations demanding local units.

Some of the more important considerations, with special emphasis on lighting needs for machine tools, are presented in the following pages.

ADVANTAGES OF GOOD ILLUMINATION

Illumination is a factor of primary importance which affects environment in every industrial establishment. The beneficial effects of good illumination, both natural and artificial, have been established in extensive tests over many years. The advantages to industry are many:

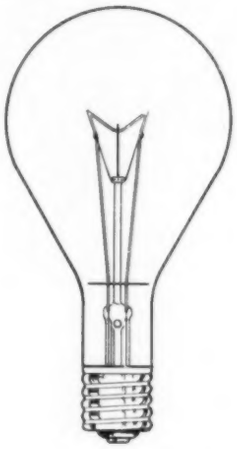
1. Greater accuracy of workmanship resulting in an improved quality of product with less spoilage and rework.
2. Inceased production and decreased costs.
3. Better utilization of floor space.
4. Greater ease of seeing, especially among older employees, thus making them more efficient.
5. More easily maintained cleanliness and neatness in the plant.
6. Less eyestrain among employees.
7. Better supervision of workers.
8. Improved morale among employees, resulting in decreased labor turn-over.
9. Greater safety.

INCANDESCENT FILAMENT LAMPS

THEORY OF OPERATION—*involves production of light in filament lamps by heating tungsten wire to incandescence (from 4530° F. for 60 watts to 5540° F. for 10,000 watts) by the pressure (volts) required to force electric current (amperes) through the wire in opposition to its resistance (ohms)*

THE contribution of incandescent lighting to industrial progress through the years is well recognized. As a matter-of-fact, the flicking of a light switch has become part of the American scene. But the very fact it has been taken for granted raises the question of how much attention has been paid to the quality of light in industrial installations.

Lamps have been refined progressively and fixtures, engineered to specific applications, have kept pace. Someone once said that anyone with a piece of tin can manufacture a light reflector. And many of the fixtures used in industrial interiors might well bear this out. The accompanying condition of poor and damaging light bears excellent witness to the fact that lighting fixtures can only serve a functional purpose when they are engineered properly.



Filament lamps are typified in this sketch. Electric current passing through the filament must overcome its resistance and the power consumed heats the filament to incandescence. Tungsten is the chief filament material and may be used as straight wire, a coil, or a coiled-coil. Coiling reduces gas losses and increases efficiency. Gas, usually a mixture of nitrogen and argon, prevents rapid evaporation of the filament

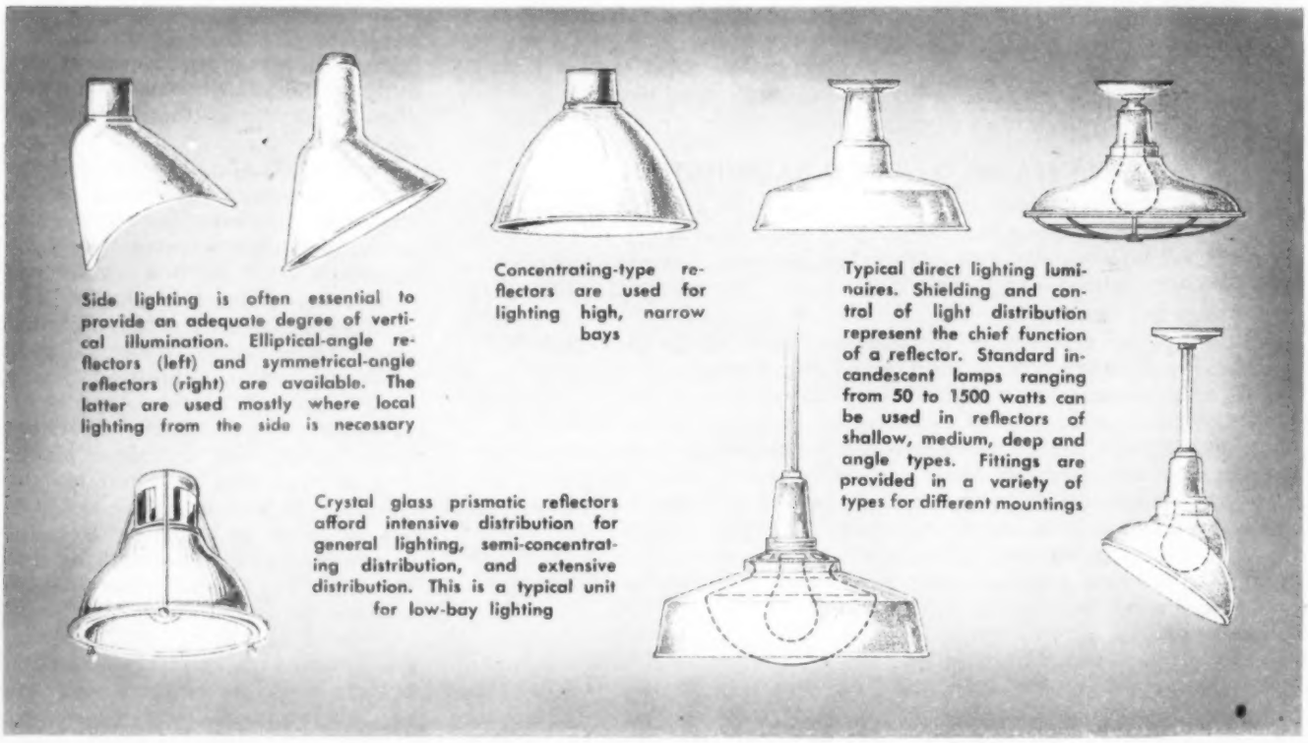
Consisting mainly of a base (generally of the screw type), a glass bulb (generally frosted inside and often coated with a reflecting surface), and a filament, incandescent lamps are rugged in construction and can take much abuse in service.

Freedom from the need of auxiliary equipment, such as starters and ballasts, contributes to slashing the initial cost and upkeep. Lamps can be replaced easily and different wattages can be used in the same socket. Incandescent lamps are not materially affected by frequency of use or the turning on and off of switches.

The light from incandescent sources is subject to close control and can be projected in any direction. It has been the predominant medium for local lighting and here, again, ingenious fixtures have been devised for specific industrial seeing tasks. Local lighting units can be used with any other type of general lighting luminaires.

Incandescent lamps work equally well with alternating current or direct current. As a light source, incandescent lamps are practical for explosion, vapor and dustproof applications.

Lamp filaments are either straight wire, a coil or a coiled coil. Coiling reduces heat losses and increases lamp efficiencies. Most of the filament types can be installed in any burning position, but some lamps are designed specifically for base-up or base-down burning.



Side lighting is often essential to provide an adequate degree of vertical illumination. Elliptical-angle reflectors (left) and symmetrical-angle reflectors (right) are available. The latter are used mostly where local lighting from the side is necessary

Concentrating-type reflectors are used for lighting high, narrow bays

Typical direct lighting luminaires. Shielding and control of light distribution represent the chief function of a reflector. Standard incandescent lamps ranging from 50 to 1500 watts can be used in reflectors of shallow, medium, deep and angle types. Fittings are provided in a variety of types for different mountings

Crystal glass prismatic reflectors afford intensive distribution for general lighting, semi-concentrating distribution, and extensive distribution. This is a typical unit for low-bay lighting

MERCURY-VAPOR LAMPS

THEORY OF OPERATION—*Light can be produced under conditions of voltage and electrode construction by an electrical discharge through certain vapors or gases. The color of the light thus produced depends upon the vapor or gas used (neon, mercury, helium, etc.) and the spectrum resulting is rarely continuous as in the case of filament lamps, but is generally composed of only a few colors as in mercury-vapor lamps whose spectrum consists mainly of violet, green, and yellow-green, and is deficient in orange and red. Lamps of the discharge type are capable of producing relatively high efficiencies—from 30 to 65 lumens per watt for the mercury-vapor type.*

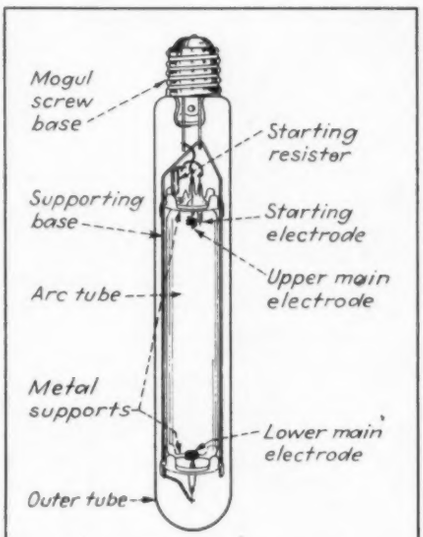
MERCURY-VAPOR lamps have gained considerable industrial acceptance for general lighting of large high-bay areas. They contain a small amount of argon gas to facilitate starting since mercury is normally a liquid at room temperature. Within a few minutes after starting, heat of the arc vaporizes enough mercury to stabilize vapor pressure. Mercury pressure increases and the arc becomes concentrated in the center of the bulb, producing a bright column of light.

Mercury-vapor lamps take from five to seven minutes to reach full light output. Starting current for this source is about 60% higher than the operating current. This emphasizes the care necessary in selection of wire sizes and circuit protective devices.

Recommended burning positions of high-intensity mercury-vapor lamps must be adhered to and it is essential that maintenance men be familiar with instructions. Lamps designated for vertical burning positions will burn out if they are tilted more than 10° from vertical. This is caused by bowing of the arc stream.

The 400-watt, 1000-watt, and 3000-watt mercury-vapor lamps are receiving widest use in industry. An indication of the high-bay lighting possibilities offered by the 3000-watt lamp is seen in its lumen rating—approximately 120,000 lumens initially (after 100 hr.). This output is 7½ times that of the 400-watt lamp and means that fewer units are required to produce a given footcandle level, with consequent reduction in maintenance costs. Both the 400-watt and 3000-watt sources have initial lamp efficiency of 40 lumens per watt.

The 1000-watt lamp is air-cooled and produces 60 lumens for each watt of electricity consumed. Its total output of 60,000 lumens is equivalent to the light cast by a canopy of 125 incandescent lamps of 40-watt size, or three times the output of a conventional 1000-watt incandescent lamp.



The 400-watt mercury-vapor lamp consists, essentially, of two main electrodes located at opposite ends of the 7½-in. tube. Mercury in the arc tube is measured carefully to maintain quite an exact vapor pressure

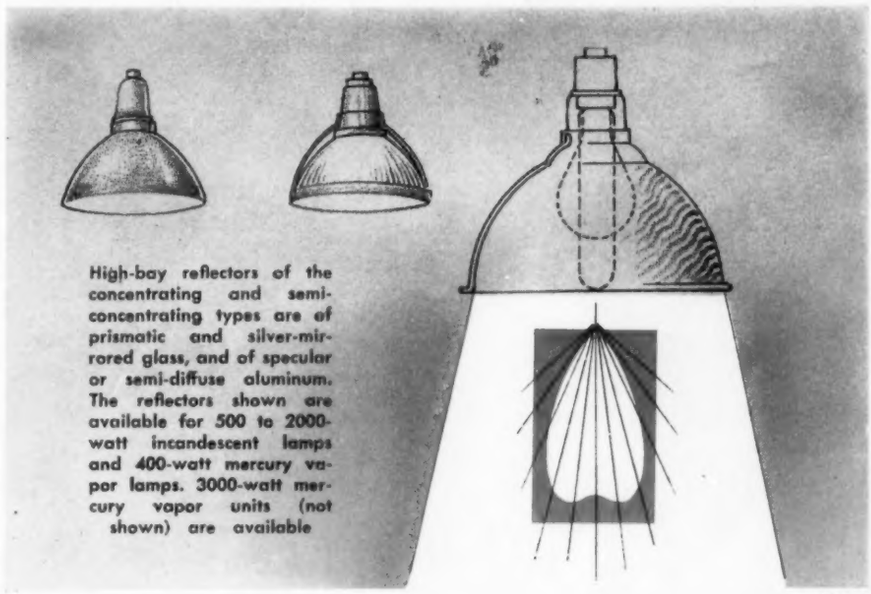
These lamps require auxiliary equipment, known as transformers or ballasts. Transformers furnish proper lamp voltage and current ballasting by means of high inductance characteristics. Transformers are available that permit operation of two lamps in a twin unit only slightly larger than the one-lamp style. Each type of lamp requires a separate transformer because of different electrical characteristics.

Two lamp transformers for mercury-vapor lamps use the split-phase principle and provide high over-all power factor, good stability, line starting current, less than the operating current, lower first cost, lower power losses and lower wiring costs.

Reduction in light output of mercury-vapor lamps at the end of rated life is slightly higher than incandescent lamps. Rated life is considerably longer than for incandescent lamps, being 3,000 hr. for five burning hr. per start and 5,000 hr. for 10 burning hr. per start.

Combinations of mercury-vapor lamps and incandescent lamps present efficient high-bay illumination. Since the vapor-type units are virtually devoid of red light, they tend to distort the color of colored objects. Excess reddish light of incandescent lamps balances effectively the greenish-blue quality of mercury-vapor lamps.

If the current is interrupted while the lamp is in operation, the lamp cannot be relighted until it has cooled enough to reduce the mercury-vapor pressure sufficiently to allow the arc to restrike, which occurs automatically if current is on. This is likely to be a disadvantage where lamps are often switched on and off.



High-bay reflectors of the concentrating and semi-concentrating types are of prismatic and silver-mirrored glass, and of specular or semi-diffuse aluminum. The reflectors shown are available for 500 to 2000-watt incandescent lamps and 400-watt mercury vapor lamps. 3000-watt mercury vapor units (not shown) are available

FLUORESCENT LAMPS

THEORY OF OPERATION—*The fluorescent lamp is essentially an electric-discharge source, consisting of a tubular bulb coated on the inside with phosphors (fluorescing chemicals) and containing a small amount of argon (for starting) and mercury vapor at low pressure to produce short wave ultra-violet which excites the phosphors to generate light efficiently in many colors. At each end of the tube is a small electrode coated with emission material which, when heated, provides a copious flow of electrons to facilitate starting at low voltages and to increase lamp life and efficiency at high output per foot of tubing.*

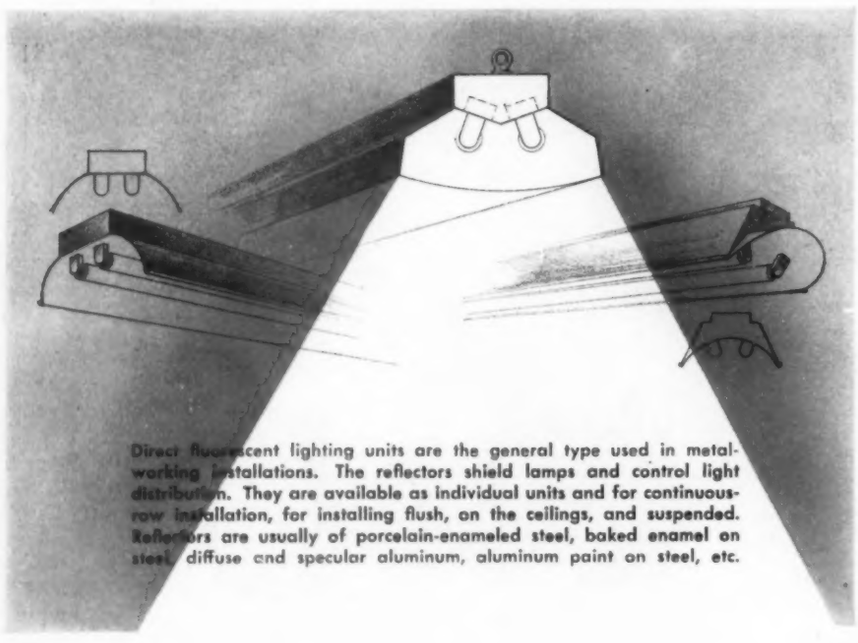
COMPARATIVELY new as an industrial lighting source, fluorescent lamps have gained in acceptance to a point they will undoubtedly predominate in the years to come. Fluorescent lighting is headed for a long series of improvements that, according to the best information available, will iron out virtually all of the wrinkles complained of in present-day installations. Further research into gaseous-discharge elements might well lead to new lamps of the future providing ever-better light.

With the removal of war restrictions, manufacture of fluorescent lamps in a variety of types and fixtures conforming to functional lighting will reach great heights. Lessons based on wartime experience, when fluorescent units were tried under most rigid conditions, will be invaluable as manufacturers strive for the ultimate in fluorescence as a lighting medium.

Fluorescent lighting has been somewhat confused by the introduction of two types—hot-cathods and cold-cathode. Proponents have praised the virtues of each type, sometimes to a point of disparaging the other. Regardless, both types have advantages and limitations, and both will have a very definite place in industrial installations.

The life of a hot-cathode lamp depends on the number of burning hours per start, with rated life being 2,500 hr. for three burning hr. per start; 4,000 hr. for six burning hr. per start; and 6,000 hr. for 12 burning hr. per start. With cold-cathode lamps, the number of times they are turned on and off has no effect on life, and they are generally rated at 10,000 hr. of life.

Hot- and cold-cathode lamps should depreciate in light output at the same rate. Slightly higher efficiency is available with the hot-cathode type.



Direct fluorescent lighting units are the general type used in metal-working installations. The reflectors shield lamps and control light distribution. They are available as individual units and for continuous-row installation, for installing flush, on the ceilings, and suspended. Reflectors are usually of porcelain-enameled steel, baked enamel on steel, diffuse and specular aluminum, aluminum paint on steel, etc.

Method of electron emission represents the principal difference between hot-cathode and cold-cathode sources. The first involves thermionic heating of a material until it gives off electrons; the second is to produce an electron stream by high voltage. Because of the high voltage factor, cold-cathode installations require definite planning. Installations made during the war have been quite satisfactory from the standpoint of quality lighting, long life in service and efficiency.

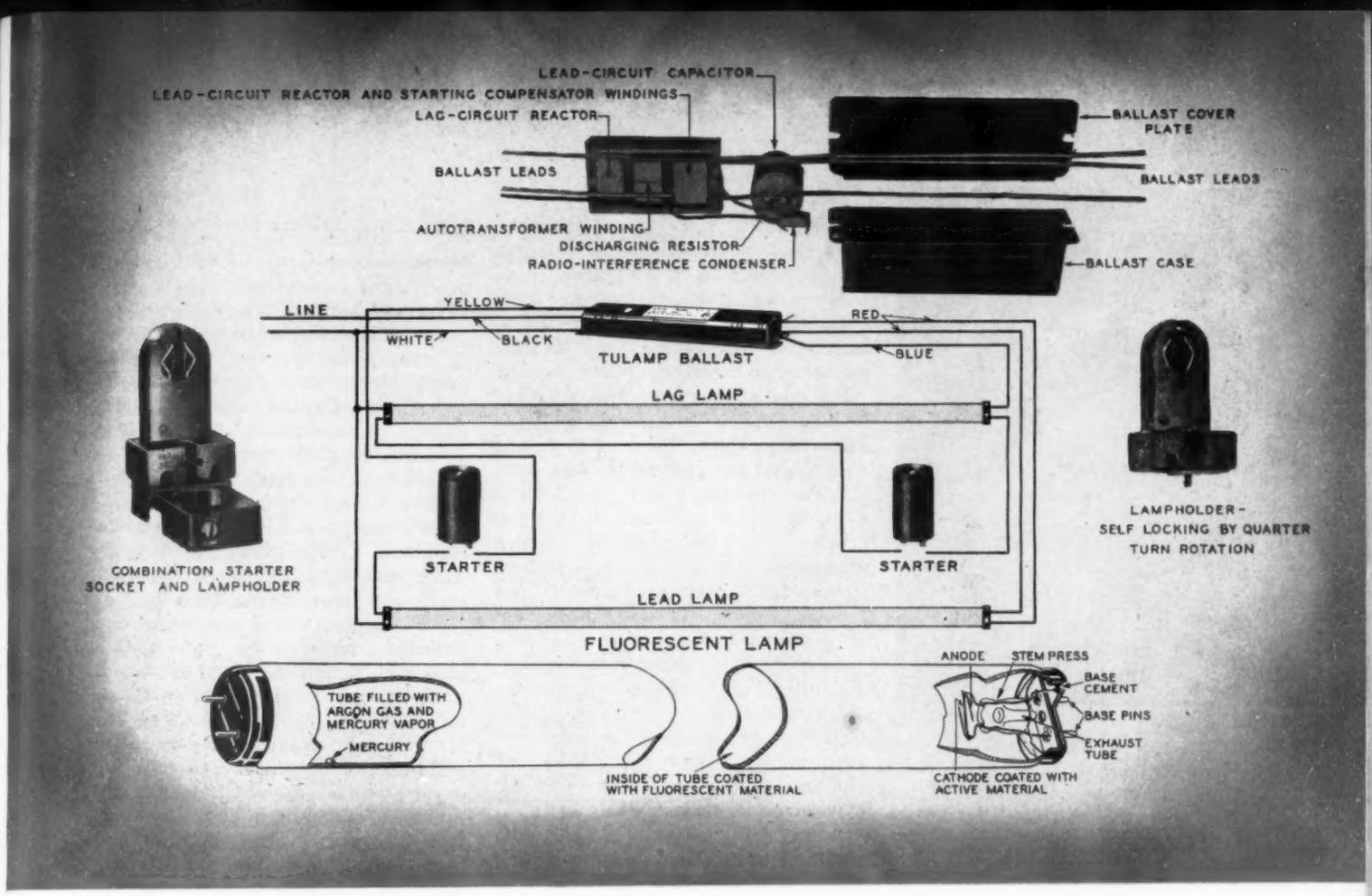
Hot-cathode types are receiving the greatest industrial use today. One major complaint—slow starting—has already been overcome by development of instant-start switches and ballasts. This is indicative of the trend toward removing objectionable features of fluorescent lighting. The two types of starter switches in general use today are the glow-switch starter and the thermal-switch starter. A cutout type of starter is also available which prevents lamps from flickering by trying to make a start at the end of life. They automatically cutout the lamp at the end of life and save on the cost of starters. Replaceable aspects of starting switches has again overcome criticism arising when they were located with the ballast inside the auxiliary case. Starting switches have been made readily accessible.

A fluorescent-lamp ballast is a coil of wire wound on an iron core placed inside a case. In series with the lamp, the proper ballast limits current to the value for which the lamp was designed. Wattage consumed by the ballast is about 15 to 30% of the lamp wattage controlled by the ballast. The choke coil introduces a lagging power factor in the electrical circuit. The power factor is usually around 50 to 60%, and that of the lamp alone about 90% because of wave distortion. Although only about half of the line current is serving usefully, wiring capacity must be planned for the total line current, that producing useful watts plus the wasted current.

Two-Lamp Ballasts

Two-lamp ballasts for fluorescent lamps use the split-phase principle with one of the lamps ballasted by inductive reactance only and the other by inductive and capacitive reactances in series. The result is an over-all power factor of 95% or more and at the same time the stroboscopic effect is reduced because of the 120° phase displacement in the two branches of the circuit.

Most modern ballasts incorporate a compensator. When this is not the case, the compensator should be wired



Typical two-lamp circuit showing wiring arrangement and component parts

in as a separate element. This will avoid unsatisfactory lamp performance, especially where lamps are started frequently.

Fluorescent lamps for industrial use generally are the daylight type and the white lamp having a rated color temperature of 3,500°K., making the color quality of its light more easily comparable to that of incandescent filament lamps.

A new lamp, known as the 4,500-white, has color characteristics which are a balance between the present daylight and white colors. The color is described as being sufficiently near daylight to meet ordinary needs for color discrimination, and is at the same time warm enough in tone to be pleasing for indoor illumination uses. Lighting specialists say the colors of most materials will appear more natural under the 4,500-white lamp.

Much has already been written in detail about the present knowledge of fluorescent lighting. Flexibility of this light source cannot be stressed enough. Continuous-row lighting is especially suitable for large areas with low to moderate ceiling heights. Standard industrial fluorescent reflectors can be recessed in ceilings to run the complete length or width of the building. Continuous channels can be used to support the reflectors and carry the auxiliaries.

Giving illumination of the order of 40 footcandles or more, continuous-row systems may cost less than equivalent systems of fixtures mounted on individual outlets. For example, savings in wiring costs of more than 50% have been realized in some plants because only one wire entrance is required for a considerable number of reflectors, reducing the number of conduit fittings and conduit length for individual fixtures.

Because of the important part measuring dials and scales play in metalworking, good illumination can be provided by installing grid systems. Continuous-row systems with regularly spaced cross-rows are effective. Fixtures have been designed with shielding and diffusing qualities that afford excellent eye comfort.

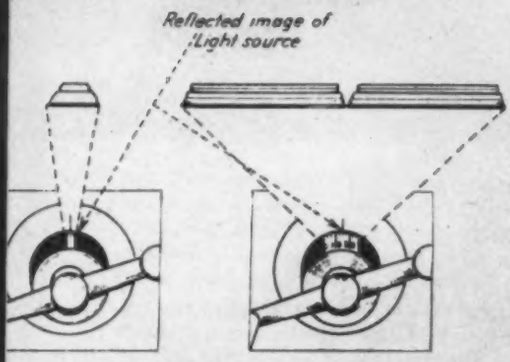
Fluorescent lamps are efficient supplementary diffusing sources, and meet requirements of bench work and fine assembly. Units can be mounted overhead out of the way of workers without causing discomfort because of heat. Shadows are softened and contrast is minimized.

COMPARISON OF LAMP EFFICIENCIES

Type of Light Source (Watts)	Lumens Per Watt (Approximately)
Incandescent	
25	10
60	14
100	16
150	17
200	18
300	19
500	20
750	20
1000	21
1500	22
3500K. White Lamp Fluorescent	
15	39*
20	43
30	48
40	52
100	42
Mercury Vapor	
250	28*
400	40
3000	40

*Does not take into account watt loss in auxiliary equipment

LIGHTING FOR SPECIFIC MACHINES



Proper placement of lighting fixtures for adequate lighting of machine dials is shown in this comparison of brightness band on dials with fluorescent equipment. Units running perpendicular to axis of rotation of the dial provide light for rapid reading

MACHINE tools have probably been subjected to more lighting gimmicks than any other comparable industrial equipment. If a machinist feels he needs more light, he rigs up his own fixture. It isn't an uncommon sight even today to walk into a shop and find machine tools draped with homemade lighting arrangements. Some of them are darn good too and really help the lighting situation. Too often, however, adequate lighting for one job creates miserable glare for others working in the vicinity. It is well to guard against such a condition.

Some companies have specialized in so-called local lighting and provide engineered fixtures which under proper installation and use are most beneficial. In this connection, machine tool builders in some instances have been considering including lighting units as part of the machine for tasks requiring good visibility. For example, the units would be controlled automatically and work only while the machine is in operation. This would save needless use of light and expense.

A well-designed general lighting system for machine tool operations is considered a must by lighting specialists. A base or minimum quantity of light throughout the industrial area is determined. If the visual tasks are particularly severe, much higher illumination over restricted areas can be added by supplementary lighting, which involves luminaires being placed relatively close to the areas.

The purpose of general lighting systems where there is supplementary lighting is to keep the brightness contrast between the well-lighted immediate work area and the surroundings within a range comfortable to the eye, sufficient for safety and protection, and to illuminate ordinary seeing tasks, and soften harsh shadows.

Much of the subsequent material on specific metalworking-machine tool lighting is based on exhaustive studies sponsored by the Illuminating Engineering Society. Some of the problems peculiar to such machines are presented with recommended solutions. Where standards are involved, it must be remembered that they are based solely on the adequacy of lighting and are more or less minimum values.

Horizontal-Spindle Machines

Engine Lathes—General lighting for precision lathes should range from 50 to 100 footcandles, depending on the type of work. While comparatively few plants provide their lathe groups with this much light, it is a goal illuminating engineers seek. Sources and reflectors offering large area low brightness are best.

The lathe operator's eyes are kept busy following the cut, reading machine dials or portable measurement instruments. He must watch carefully each step to obtain accurate setup and minimize spoilage.

For circular scales and dials, the reflected image of the light source must be a uniformly bright band, wide enough to cover at least one complete set of divisions. The reflected image should cover the entire scale for flat scales. This permits the operator to see the cut numbers and divisions on the semi-polished surface accurately. Small fixtures and the usual local machine lights are not held adequate because reflected images are too small and bright, and the extreme contrast creates glare.

For boring operations, widespread reflectors extending beyond the tailstock send light vertically to the point where the cut starts. It is also useful for facing operations, usually made near the tailstock. Sometimes local lights are helpful in checking for chatter. Generally, however, good general illumination eliminates the need for local lighting.

The most common lighting for lathe groups are symmetrical layouts of filament lamp units; symmetrical layouts of individual fluorescent fixtures; and continuous rows of fluorescent units. Lighting specialists studying the situation believe the best solution is a grid system of fluorescent fixtures. It is suggested further that lathes be placed to an angle of 45° to the long axis of the lighting fixtures. This helps to spread out the reflected image of the continuous line of light, and minimizes shadows.

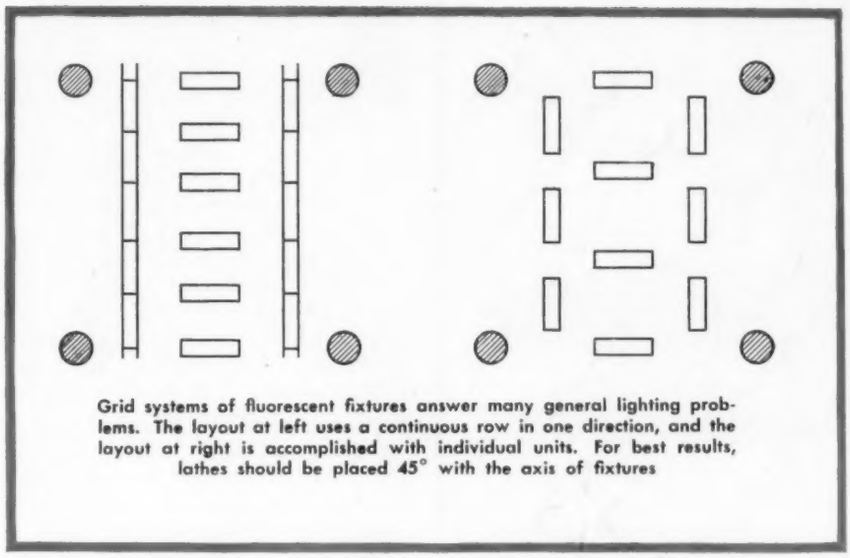
Turret Lathes—General illumination in a grid pattern is recommended with supplementary lighting, if necessary, for deep holes. In using local lighting, the splatter of cutting oil is a consideration. Enclosed units with slightly diffusing glass are considered best because they can be kept clean easily. Reflectors must be kept out of the path of swinging turrets.

The lighting principles for seeing are much the same as for engine lathes. Setting up work and checking for accuracy are the main seeing tasks. A higher level of illumination is often necessary because of the dark area formed around the tool point by cutting oil.

Screw Machine—Location of machines midway between uniform rows of continuous fluorescent fixtures is effective. Clear seeing for precise setups, and for reading graduated dials and machinists' instruments is essential. Where projections or oil-splash shields intercept light, it might be necessary to use supplementary fixtures mounted rigidly either from the ceiling or attached to the machine. Enclosed units are again advisable.

Horizontal Boring Machines—A good general lighting system plus a portable stand unit serve well. Special fixtures for inspecting deep bores have been developed. One can be placed in the closed bore and the surface inspected as the fixture moves in or out. Another uses a mirror for receiving the lighted image of the inside of the bored hole.

Grinders—The setting-up operation of the grinder is usually not particularly severe. General lighting should provide for sufficient light at the work area during setup operations. With internal grinders, the hood may intercept considerable light. Painting or placing an insert of high reflectivity inside the hood will redirect light to aid in reading the indicator. The design of general lighting must take reading of measuring instruments into account.



Grid systems of fluorescent fixtures answer many general lighting problems. The layout at left uses a continuous row in one direction, and the layout at right is accomplished with individual units. For best results, lathes should be placed 45° with the axis of fixtures

Vertical-Spindle Machines

Single-Spindle Machines—Recommended minimum standards approved by the ASA are: Rough Bench and Machine Work, 20 footcandles; Medium Bench and Machine Work, 30 footcandles; and Fine Bench and Machine Work, 50 to 100 footcandles.

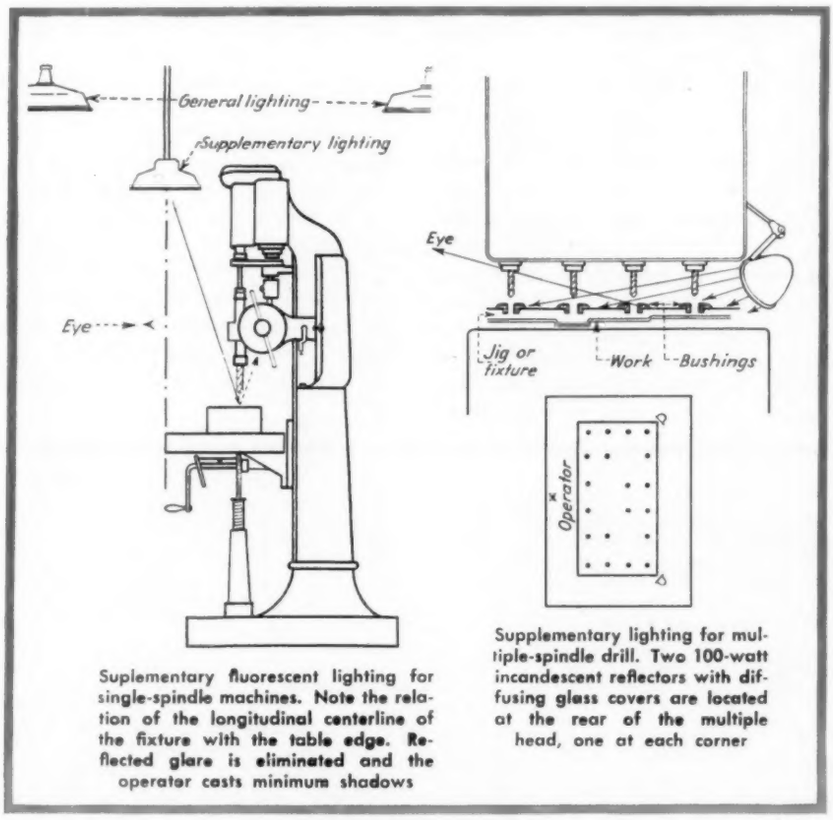
Fluorescent lighting meets virtually all of the general lighting requirements and is particularly advantageous in providing high intensities at low mounting heights. Incandescent units, meeting specifications for brightness and shielding, are practical for low mounting heights. A combination mercury vapor-incandescent system is well adapted to high-bay lighting.

Machine arrangements often make local lighting essential. Fixtures should be chosen for shielding and light directing qualities and the ratio of footcandle values of the local and general lighting systems should not exceed 10 to 1, although the trend today favors a ratio of 3 to 1.

Mounting of a supplementary fluorescent fixture just high enough to clear the single-spindle machine and located in front of the spindle so its longitudinal center line reaches the front end of the table serves effectively.

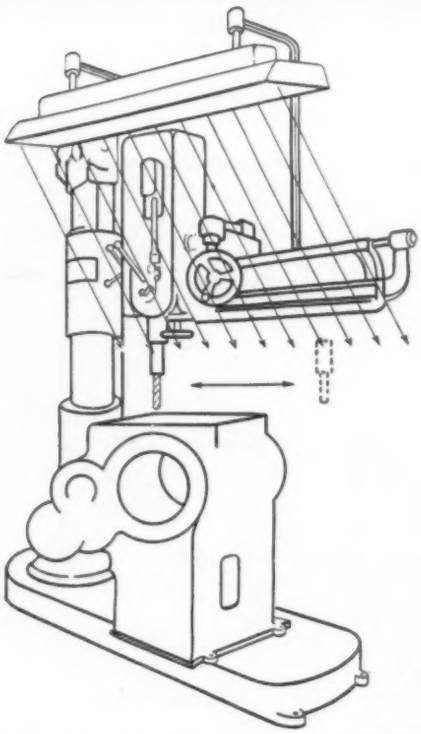
Multiple-Spindle Drills—The same general lighting sources serve for these machines with illumination ranging from at least 20 to 30 footcandles. Proper lighting of the rear drills is an important consideration in this group of tools. Local lighting units placed at the rear of the multiple head and at each corner so they shine to the diagonally opposite corner in nearly a horizontal plane can provide a satisfactory solution. Work and drill points are visible because of reflected glow from rear lights.

Radial Drills—A combination of general and local lighting fills the bill,



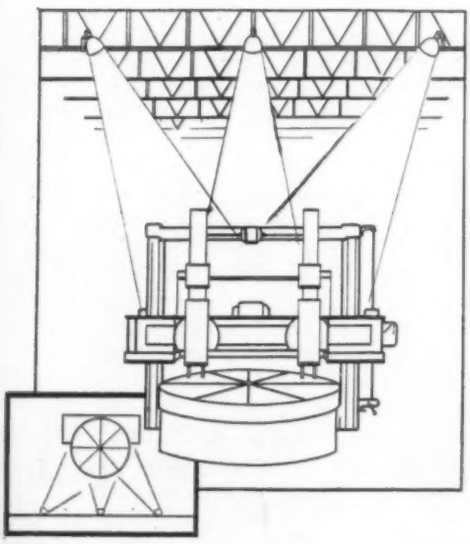
Suplementary fluorescent lighting for single-spindle machines. Note the relation of the longitudinal centerline of the fixture with the table edge. Reflected glare is eliminated and the operator casts minimum shadows

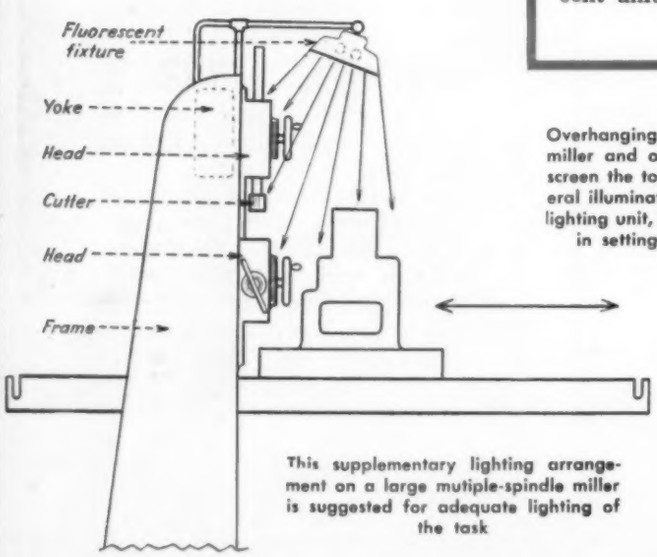
Supplementary lighting for multiple-spindle drill. Two 100-watt incandescent reflectors with diffusing glass covers are located at the rear of the multiple head, one at each corner



Supplementary lighting for radial drill. An RLM-type fluorescent unit is attached to the radius arm and mounted so as to illuminate the drill point, dials and controls

Supplementary lighting for a large boring mill. Three 500-watt louvered concentrating projectors are applied in a high bay to provide adequate intensities at working points





This supplementary lighting arrangement on a large mutiple-spindle miller is suggested for adequate lighting of the task

particularly if the room is high and equipped with overhead cranes and booms. Good lighting at the drill point, feed dials and controls is essential. Harsh shadows caused by the operator and the radius arm can be dissipated by attachment of a fluorescent supplementary unit to the radius arm. Or where the work forms a barrier, fluorescent fixtures can be attached at the front and rear. Light is thus thrown in front of and behind the drill. The fixture or fixtures are not in the way because the radius arm can be moved away during handling operations. Portable or adjustable units have not been deemed feasible.

Boring Machines—High-intensity, high-quality light covering the various tool points and machine adjustments is necessary. Incandescent or fluorescent units properly spaced can meet requirements. Large boring machines in high bay areas present somewhat of a problem. Projection equipment properly louvered and pointed at the work at an angle of not less than 20° should provide good light at the cutting points and feed dials.

Milling Machines, Shapers and Planers

Vertical Milling Machines—Local lighting units are definitely needed for setup operations on these machine tools. It is probably one of the best examples where good, functional local lighting is required because the machine and work generally screen the point of vision from direct general illumination. Much of the work on these machines involves metal castings held in position by jigs or fixtures. Polished metal surfaces make it necessary that lighting be of uniform brightness over a considerable area of the work.

Horizontal Milling Machines—Good general illumination either of fluorescent type or incandescent units with diffusing units is recommended. Fluorescent units should be placed diagonal to the machine tables to insure adequate vertical illumination on the front and sides of the machines. A grid system can be used effectively. If incandescent units are used, care must be taken to avoid sharp shadows and reflections of high brightness.

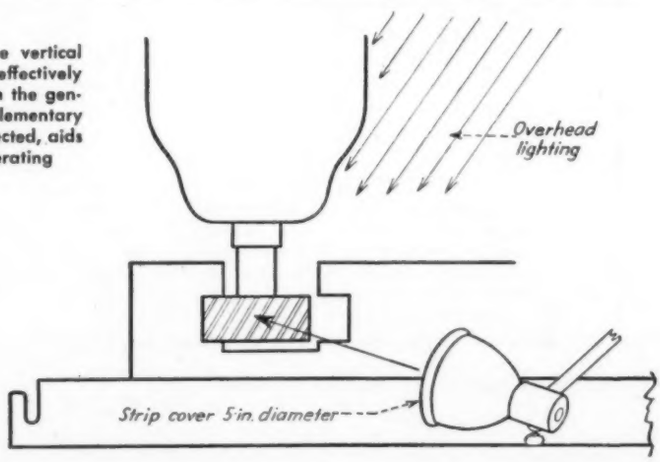
The variety of machine operations, ranging from milling flats on the end of a shaft to cutting of complex castings, often necessitate supplementary lighting. Overarms supporting the far end of the spindle cause shadows and must be considered in locating the machine under the lighting system. Local lighting units on each side of the overarm are helpful, providing they have proper reflectors and are adjusted so as not to interfere with the vision of the operator or workers at other machines.

Milling of large castings on horizontal multiple-spindle millers generally involves handling by cranes. This makes general lighting somewhat difficult and can be compensated for by mounting fluorescent units about 12 inches in front of the yoke on arms extending from the yoke. This permits the operator and setup man to see fine details.

Shapers and Planers—Vertical illumination of sufficient candlepower to aid in making machine adjustments easily is important. A U-shape arrangement of fluorescent fixtures mounted as low as feasible will direct good light to vertical surfaces on the front and sides of the machine. Shadows made by the machine itself must be considered in providing proper light for critical seeing tasks in setting up the work.

Universal Grinders—A large-area light source is important when work is being removed from under the grinding wheel so it can be examined quickly for defects, which will be silhouetted against the bright background of the polished surface. Sometimes it is necessary to mount units side by side to assure a large-area

Overhanging parts of the vertical miller and of the work effectively screen the tool point from the general illumination. A supplementary lighting unit, properly directed, aids in setting up and operating



light source having dimensions at least as great as the work.

Sheet-Metal Fabrication

Shears—Shadow can be used effectively in shearing operations. Narrow slots varying in size in different machines are located between the hold-down yoke and the shear blade. One study of this type machine recommends that 50-watt, rough-service lamps in deep-bowl reflectors be mounted above the slot and as close to the yoke as possible. The lamps should be located so the upper shear blade casts a shadow which coincides with the lower cutting edge. The shadow edge will then mark the point of adjustment of scribed marks for an accurate cut.

Fluorescent fixtures are suitable for lighting measuring scales. They should be mounted so the light parallels the scale to eliminate shadows and light streaks. Backstops should be lighted in a manner similar to front scales.

Sheet-metal Brake—If the bulk of the sheets to be bent are bright cold-rolled stock, lighting fixtures should be located over the brake nose to avoid shadows. Scribed marks will then appear dark against the bright sheet metal and can be viewed easily. If the metal is dark, hot-rolled stock, then the light sources should be located somewhat in front so scribed marks will be viewed as bright lines against a dark background of metal.

Power Brakes—Light should come from both the front and rear of large machines. Particular care must be exercised in lighting this equipment to avoid shadows. The angle of light must be considered to assure adequate visibility at the die. The level of general illumination should be about 35 footcandles. A large machine should be surrounded by at least four fixtures, spaced not more than 10 x 10 ft., with 500 watts per fixture for incandescent and 200 watts per fixture for fluorescent. Fluorescent fixtures are recommended for layout tables because scribed lines are best viewed under large-area, low-brightness fixtures. If the materials being worked have specular qualities, the fixtures should afford diffusion.

Punch and Forming Presses—Polished die faces are best seen when the light source is imaged or mirrored. A low brightness source is recommended. Portable lighting units are often necessary in these operations and care should be taken to see that nearby workers are not subjected to glare. General illumination of either incandescent, fluorescent or mercury sources should supply at least 20 footcandles, unless presses are poorly arranged and require a minimum of 35 footcandles.

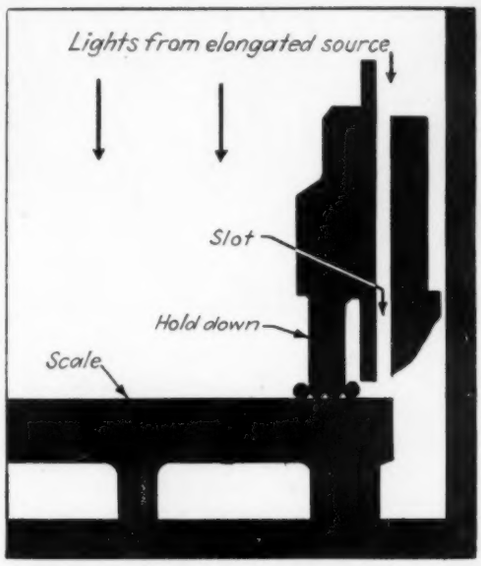
Large Forming Presses—Such presses can be lighted from the four upper corners with 50-watt rough-service lamps in porcelain reflectors if the units can be placed close to the die. If the units must be located a distance away, 100-watt lamps or larger should be used in projection-type reflectors with diffusing covers. The important point to remember is that light must be thrown into the dies.

Welding

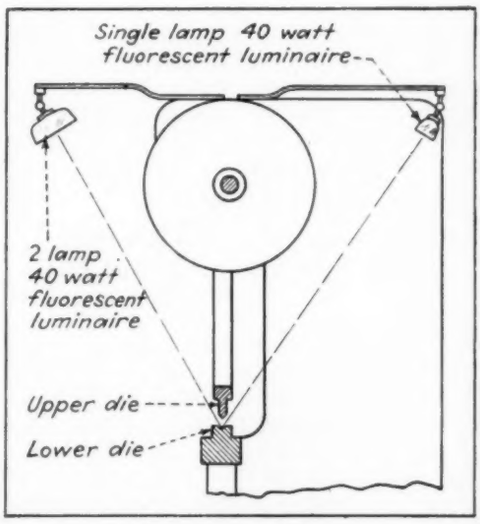
The advantages of good lighting in welding operations seem to have been overlooked in many plants. The very nature of the work is trying to the eyes of welders and studies made in plants and laboratories have produced substantial proof that adequate lighting facilities are beneficial. Much higher values than 30 footcandles have been held desirable. They permit the welder to see more readily when he throws his hood back to inspect the work.

The lighting in one plant has been raised to 150 footcandles. It is not only beneficial to the welders, but other workers in the area find it helpful because it minimizes the bright flashing of welding operations. Mounted 13 ft. above the floor, 400-watt, type H. mercury units on 7 x 8-ft. centers are used. The mercury-vapor source emits a blue-green color which harmonizes with the welding arc.

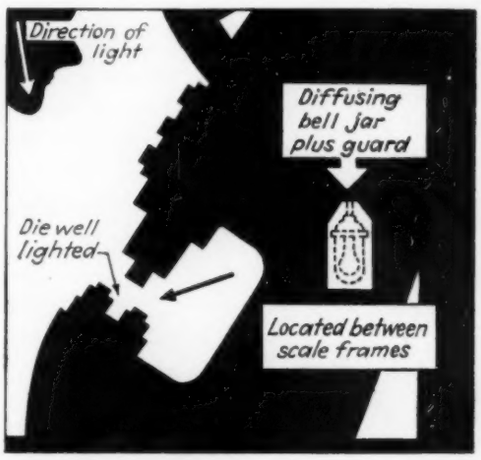
Many plants use welding booths. Shadows on the work and reflections on the back of the welder's hood window are often found. A solution offered after a study suggests two 20-watt lamp fluorescent fixtures located in a vertical position at the outside corners of each booth.



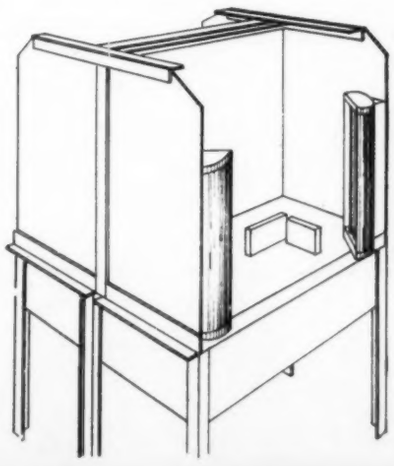
Power shear lighting takes advantage of shadow. The shadow indicates accurately the line of shear. The scribe mark is aligned with the shadow edge. The extended light source helps in reading scales



Supplementary lighting arrangement for a power brake

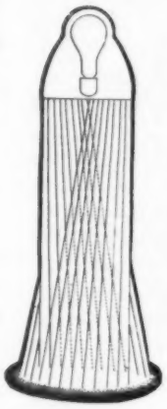


Recommended punch press lighting indicates the proper location of the overhead light source. A local source casts a sheen over the face of the lower die, disclosing surplus stock, foreign matter, cracks and corner clipping



Vertical fluorescent luminaires flanking outer edges for minimum shadows are often efficient in lighting welding booths

SUPPLEMENTARY LIGHTING



Supplementary or local lighting is more than just throwing a lot of light on a specific area. The fixture should be such that it can be trained on a specific area without throwing glare at others working at nearby machines. This principle of local lighting shown has been recognized as affording scientifically correct lighting. Light rays reflect into a converging beam about 18 in. from the reflector

AS THE name implies, supplementary lighting takes up where general lighting leaves off. It is designed to augment rather than replace good general lighting systems. Basically, supplementary fixtures are installed to increase illumination on work surfaces by 100 to more than 250 footcandles. It is considered good practice to use a ratio of 3 to 1 for output of supplementary sources to general sources.

A wide assortment of supplementary or local lighting luminaires is available. In most instances, they are marked improvements over the inadequate reflectors commonly used in years past. They represent scientific analysis of lighting problems, taking into consideration the elimination of glare factors so inherently connected with local lighting units of the past.

Despite the improvement of fixture design, supplementary lighting can still be mishandled and misused in service. Invariably, each critical working task has visibility factors which merit study and analysis. Glare is an important consideration, but beyond this is the reflection value of the material being worked, elimination of uncomfortable contrasts, and proper location of the units.

Supplementary lighting can be classified by three characteristics: distribution, area and brightness. Units with a concentrating distribution are usually small in area and high in brightness, and are used for directing light into restricted areas; units with diffusing distribution of large area with low brightness are used in special areas in the plant, such as those set aside for inspection.

Fixtures Are Flexible

Many supplementary fixtures can be attached directly to machine tools in such fashion they are not in the way of operations. Flexible arms permit operators to direct the light to the best advantage. Vibration must be considered and compensated for in such installations.

Up to this time, a majority of the machine-type supplementary fixtures have used incandescent sources. With the development of fluorescent tubes bent into circles of varying sizes, the trend seems to point to greater use of fluorescence as a supplementary lighting medium. Coolness of the fluorescent lamp seems to make it ideal for local applications where the fixture is of necessity close to the operator.

Machine designers have been paying more and more attention to the lighting needs of complex machine tools that don't lend themselves to general lighting alone. These units will be installed as part of the machine, and will be out of the way yet direct added light to the necessary work areas. Circular fluorescent tubes seem to lend themselves to many functional applications on machine tools.

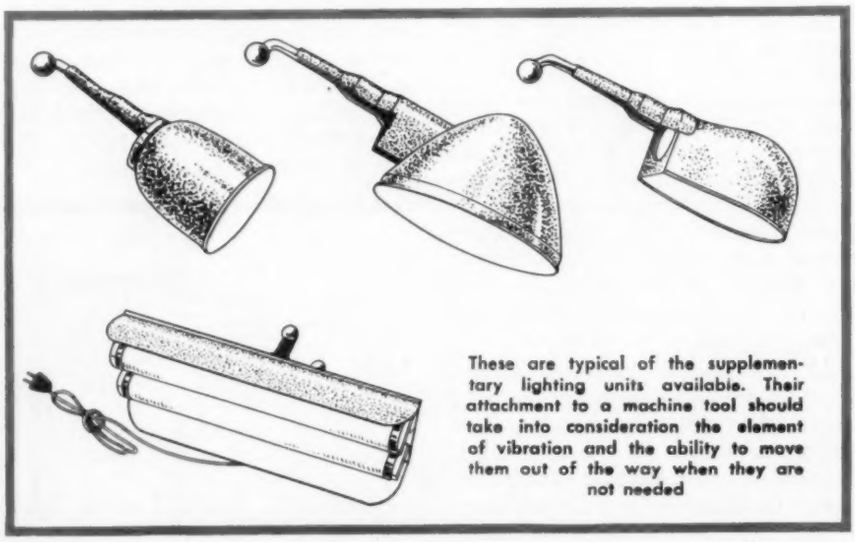
Special Dial Lights

Small fluorescent tubes have already been developed for special lighting of measuring dials and feedwheels. They are designed to avoid light streaks and improve visibility. Small, portable fluorescent fixtures are available for specific vertical lighting tasks and bear out the principle of the incandescent drop-light. Localized lighting using continuous rows of fluorescent fixtures are receiving wider acceptance for assembly and inspection operations.

Incandescent fixtures of an enclosed type with glass lens have been found advantageous because they can be cleaned more readily and direct controlled light.

Whatever the auxiliary lighting equipment used, it is well to call in a lighting expert to determine what type of an installation will best meet the given lighting problem. The quality of light rather than mere footcandle output is a prime consideration in local lighting.

Critical seeing tasks require more light at the working area than can be provided by general illumination. Vertical lighting, essential in many metalworking operations, can be achieved with flexible-type local lighting fixtures



These are typical of the supplementary lighting units available. Their attachment to a machine tool should take into consideration the element of vibration and the ability to move them out of the way when they are not needed

LIGHTING MAINTENANCE

THE best and most efficient lighting installation loses its effectiveness rapidly if maintenance programs are hit-and-miss propositions. Mere replacement of burned-out lamps is only a drop in the bucket toward realization or the full benefits of well-engineered industrial lighting systems.

Surveys made in metalworking plants have uncovered some excellent lighting maintenance programs but have also demonstrated there is much to be desired in many other plants. Since lighting is such an important production tool, establishment of a sound maintenance program has obvious merit.

Maintenance workers should be thoroughly aware of the installation itself and should comply with recommendations made by lighting specialists in connection with upkeep of lamps and fixtures. It is relatively easy to analyze maintenance requirements in specific plants. The type of operations performed plays an important part in the frequency of cleaning operations to maintain adequate light.

Gradual accumulation of dust and dirt on lamps and fixtures often goes unnoticed because of uniform deposits. The lighting value of some installations has depreciated 50% or more before it was realized that rejects, decreased production, and even accidents could be traced to lowered illumination.

Ready accessibility of all lighting units is important to efficient, economical maintenance. Many progressive companies keep extra lighting reflectors available to replace those needing thorough cleaning. Quick detachment of such reflectors is a prime consideration.

Soap and water is the best way to get lighting fixtures clean whether they be incandescent, mercury-vapor, or fluorescent. Just pushing the dust around with a dry or damp cloth isn't the answer to sound maintenance of lighting equipment. Good cleaning and scheduled relamping programs are the important factors in getting the most out of your lighting installation

Units at low mounting heights can usually be reached by stepladders. The need for taking care of equipment in higher mounting areas led to development of telescoping towers on wheels, adaptation of cranes to lighting maintenance, disconnecting hangers which permit lowering lighting units to the floor, platforms built on traveling cranes, and catwalks. From a safety angle, disconnecting hangers, which permit lowering the lighting units to the floor, have found favor.

Light meter readings form the best basis of cleaning and lamp replacing schedules. Periodic checks of the illumination by a light meter will determine the frequency of cleaning. As a general rule, when the lighting drops to two-thirds of its initial value, the equipment needs cleaning.

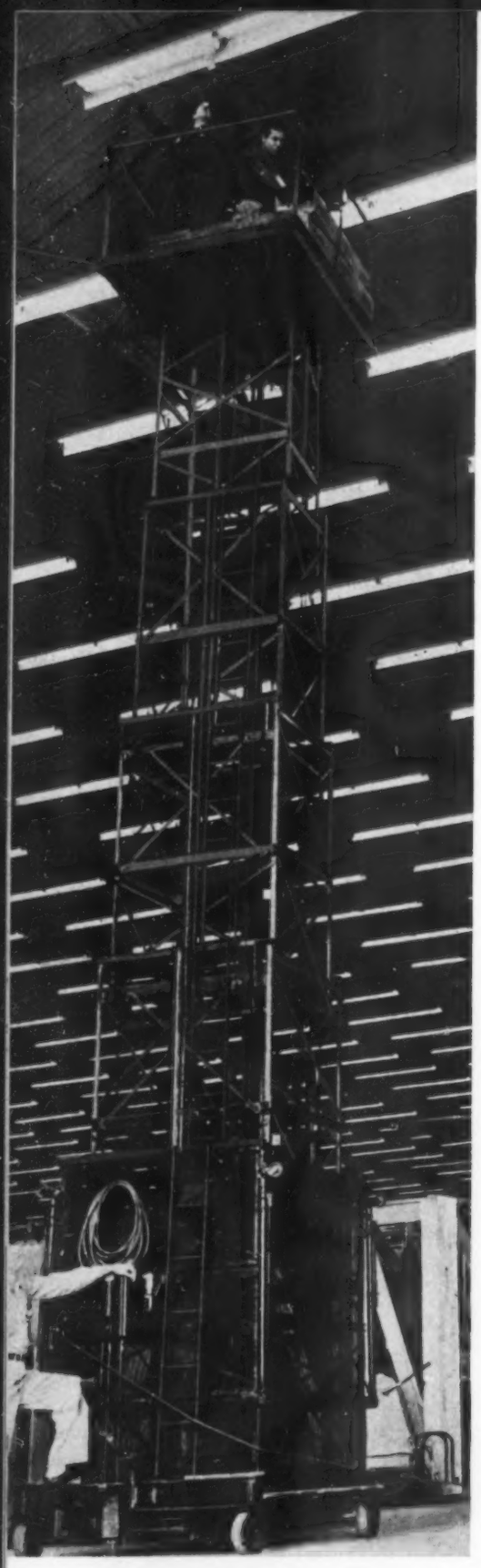
Interiors subjected to considerable dust and fumes often require that lighting equipment be cleaned every three or four weeks. Cleaning periods of from two to six months represent average conditions.

A good detergent and warm water are the best cleaning mediums. Mere wiping of lamps and fixtures with a dry or damp cloth is not considered sufficient. Alkaline detergents can be used in cleaning porcelain-enameled reflectors. Since alkali tends to attack aluminum, reflectors of this material should be cleaned with neutral detergents, a liquid wax or wax emulsions. The wax cleans effectively and leaves a thin film which makes recleaning easier.

Industrial units having a white casein base paint for a reflecting surface can be washed several times with a mild soap and warm water. Re-

Platform-type ladders afford a safe means of maintaining low-bay lights and equipment in good shape. They can be equipped with containers for carrying lamp replacements

Many manufacturers are making their reflectors so they can be detached quickly. This is a big help in maintenance programs



Telescoping portable units are often required for high-bay installations. The initial cost of this equipment can be written off to the maintenance of lighting installations at the highest possible level of efficiency

COMPARISON OF LIGHT SOURCES

	Incandescent	Fluorescent	Mercury Vapor
Color quality of light produced	Candle flame yellow to light yellowish white. Small voltage lamps in color	Daylight soft white and 3500°K. white. Also made in colors	Daylight with strong bluish-green cast
Rated operating life	750 hr. up to 150 watts 1000 hr. over 150 watts Also special life lamps	2000 to 6000 hr. Increased hours of operation per start increases lamp life	2000 to 4000 hr. Increased hours of operation per start increases lamp life
Replacement cost (Lumen hours for one cent, list price)	35,000 to 107,000 lumen hours	10,000 to 58,000 lumen hours	16,000 to 60,000 lumen hours
Lamp efficiency	10 to 22 lumens per watt	39 to 52 lumens per watt	28 to 40 lumens per watt
Size and shape	2 to 6½-in. dia. in tear drop and pear shape. Also short tubular shape	1 to 2⅛-in. dia. tubes. 1½ to 10 ft. in length	Tubular—short and long

peated washings, however, tend to decrease reflectivity. Fresh coats of paint are recommended; periodically the old paint should be removed to prevent it from peeling.

Examination of lamps can be tied in with cleaning programs. Many plants have found it economical to relamp on a group basis rather than waiting for individual lamps to burn out. Cleaning schedules can be worked out to multiples so that at points where lamps have reached 70 or 80 percent of normal life, they can be completely replaced and the system is restored to virtually initial efficiency.

Lamp Replacement Points

Removed lamps can be examined more closely. Those about ready to burn out can be discarded and lamps indicating further service can be used to replace early burnouts in the replacement group. Group replacement is particularly effective in large areas of uniform lighting where lamps approach the end of life together. It restores the lighting installation to full efficiency at definite intervals.

Incandescent and mercury-vapor lamps can be removed rather easily and permit rapid checks to determine whether the wiring system is influencing early burnouts.

Challenge of Fluorescent Units

Fluorescent units of both individual and continuous-row types have been designed for ready accessibility but the length of lamps and fixtures present a new problem challenging the lighting industry. Manufacturers are taking great pains to educate users in the use and maintenance of fluorescent equipment.

Lamps usually produce black bands at one or both ends as they near the end of life. Sometimes a small mercury deposit condenses near the ends or causes dark streaks to appear on the lower part of the lamps. These should not be confused with normal end blackening.

Heavy end blackening early in the life of fluorescent lamps indicates something wrong with operating conditions. Circuit voltage should be checked against ballast rating; loose contacts or poor seating might be the cause; defective or worn-out starter might be at fault.

WE ACKNOWLEDGE . . . *The helpful assistance of lighting equipment manufacturers and the Illuminating Engineering Society made possible the presentation of this special report. The cooperation of General Electric, I.E.S. representatives, and Westinghouse in supplying data and illustrations, and in checking the manuscript was invaluable. Among the companies assisting in this special report are:*

Benjamin Electric Mfg. Co.
Bulldog Electric Products Co.
Federal Electric Co., Inc.
General Electric Co.
Holophane Co., Inc.
Sylvania Electric Products, Inc.
The Cleveland Elec. Illum. Co.
The Fostoria Pressed Steel Corp.
The Thompson Electric Co.
Westinghouse Electric Corp.

Teamwork Among Machinists

THE WRITER, a World War II veteran, considers himself a fair machinist who came by his knowledge the hard way. Rebuffed many times in his determination to improve his qualifications as a machinist, he appeals for machine-shop teamwork by urging experienced operators to extend a helping hand to those coming up the ladder. Round Table topics and the discussions they have drawn prompted him to "write these things off my chest"

BY EDWIN A. HOPPE

MACHINISTS can be classified as thoroughly qualified, fair, or poor. I consider myself in the "fair" classification. Since I was graduated from a technical high school in 1931, I have tried to make the machinist's trade my career. Many stumbling blocks have been placed in my way, but I'm still hopeful the future will lead to a situation where experienced machinists will use helpful understanding and consideration in dealing with less-experienced operators.

I might be considered a "book" machinist, but books do give a man an understanding of how to perform work in the best, most efficient manner. I have obtained many books and manuals on new tools, machines, coolants, oils, metals, other materials, and instruments. I haven't just read the literature, I've studied it thoroughly. The lessons learned have proved helpful on many occasions in practical application. Furthermore, I have attended accredited trade schools to learn my job better and be worthy of the name "machinist."

Having served in the armed forces for three years during World War II, I plan to attend another trade school under the "G.I. Bill," and I have chosen one of the best. I am confident this training will increase my knowledge, but from then on experience will count and I will be at the mercy of qualified machinists and foremen. Their attitude will tip the scales in favor or against my reaching the thoroughly qualified stage associated with practical endeavor.

Regarding the toolbox and tools, I have a darn good box, my tools were selected and bought with thought and care, and I can use every tool with accuracy and competence. I didn't enter a toolmaker's store, throw down $200 and say, "Mix 'em up good." So please don't judge those in my position by their tool chest and tools. Reserve judgment until you have seen us use the tools. Remember, "Don't judge a book by its cover."

Instead of criticizing us, how about helping us? Maybe it will be wasted on some, but I'm certain the satisfaction you receive from watching others advance will more than repay you. The success of our combat teams during the war can be traced to teamwork—experienced combat men helping rookies.

Teamwork in a machine shop or toolroom can prove just as successful. The respect experienced men will receive is something money can't buy. Whenever an experienced machinist helps me out on a job in the shop, we both are satisfied and the company is ahead because teamwork, gentlemen, is unbeatable.

I have no kick with licensing machinists, but I think it might hamper rather than help us. I suggest that a board be established to prepare examinations containing written and oral questions, plus actual shop-practice tests. A series of grade or rating schedules could be set up, such as third, second, first and master machinist or toolmaker.

After taking an exam, a man's license would carry his rating. An employer would know immediately the type of worker he is hiring and how much to pay. Machinists feeling they are entitled to higher ratings could be reexamined. Each man should, however, keep his rating for a certain time, regardless of experience: third class, 9 months; second class, 14 months; first class, 24 months.

Some who read this might think I'm looking for Utopia, others might consider my statements as a pet "gripe." I'm hoping, however, that some might be influenced to extend a helping hand or at least put teamwork to the test. A top machinist, in my opinion, is the man who can do his job well, has the interests of his employer at heart, and is willing to cooperate in the training of men who will carry on when he has passed the working stage in life.

OUR SHOP. . . 8 — *"Inhuman Relations . . ."*

Probability and Quality Control—II

APPLICATION TO MACHINE PARTS

BY EUGENE GODDESS, SPECIAL PRODUCTS ENGINEER
NORTH AMERICAN PHILIPS COMPANY

Deviations from a low-tolerance specification are bound to occur in parts made in mass production. Statistical quality control has aided engineers in setting up and maintaining sound tolerances

BEFORE DESCRIBING some of the applications of statistical quality control in modern machine-shop practice, it would be well to discuss briefly (leaving out many details) how the controls operate.

Suppose we wish to control the length of a bar which is cut on an automatic saw. The bars are supposed to be 1 in. long. A sample of five pieces is taken periodically (each hour, each shift, etc.) and the average value $\overline{X}$ is computed. Then the difference in value between the largest and the smallest is determined—this value is termed the range R. These values are then plotted on suitable graph paper. After a number of these averages $\overline{X}$ and ranges R have been plotted, they are treated statistically to establish mathematically the limits within which the machine might be expected to work.

When measured values are found which exceed these control limits, it is assumed that the variations are large enough to be due to assignable causes. Such causes are then sought out and removed, in which case subsequent periodical sampling will give in-limit values of $\overline{X}$ and R.

Perhaps the first place where statistical methods can be used in the shop is in the establishment of intelligent enforcable tolerances. One case comes to mind where production involved so many tolerances that it was dificult to establish which ones were actually being used.

In this instance, the tolerances given in the blueprint were ±0.001 in. The shop, however, by negotiating with the inspector had the latter actually use a tolerance of +0.002—0.003 in. Examination of the actual product coming from the machine showed that tolerance of its product was ±0.003 in. Meanwhile the gage used by the inspector was worn to a dimension of +0.003—0.002 in. Further investigation showed that the product would be perfectly suitable if the dimension varied from the specification by as much as ±0.004 in. And during all this headache, the customer was requiring a specification tolerance of ±0.001 in. Usually, when tolerances are reduced in an arithmetic progression, the costs of production increases approximately as a geometric progression having a common ratio of 2. Thus, if it costs $1 to maintain a tolerance of ±0.004 in., it will cost $2 to maintain a tolerance of 0.003 in.; $4 for a tolerance of ±0.002 in., $8 for a tolerance of ±0.001 in. The above example cites a good instance of waste caused by excessively tight tolerances. The cure was effected by adopting the broadest tolerances, and enforcing them by using quality-control methods.

Results Anticipated

Utilization of control techniques and records over a period of time will often indicate in advance how many pieces can be made with a given die. By changing dies at intervals determined by quality control, it becomes possible to anticipate wear and thus reduce the number of out-of-specification parts. If one bothers to place his printed tolerances on a utility standard, then the use of a given die can easily be extended.

One should not dismiss the question of tolerance too lightly. For example, consider the manufacture of openend wrenches and spinner-type nut wrenches. In both cases, a statistical analysis must be made in order to determine the optimum economic wrench size. First, nuts of the given size produced by different manufacturers should be analyzed. Tolerances will vary depending on the source of supply. Second, the wrench must be designed to fit easily over the largest nut—yet it must not slip when a torque is applied to the smallest. Third, machinery used to produce the wrench must be analyzed too, to determine what accuracy is inherent in such equipment. Fourth, apply the broadest economic tolerances commensurate with a good product to determine whether it can be made in the factory under study. The requirements uncovered by these statistical analyses may show that it is not wise to produce the wrench at all. Finally, if it is to be produced, quality-control techniques should be carefully applied to insure that the product is held to specifications.

The Glenn L. Martin Company[9] revealed how statistical methods have been applied to inspection of purchased bolts. Such elements as magnetism, surface defects, flaws in the shank and head, and tensile strength all had to be given proper consideration. Statistical methods provided the means for control of quality through adequate scientific sampling.

Persons who run automatic screw machines are prone to adjust them by "instinct." The number of adjustments (and work interruptions) required on a given machine can best be shown by maintaining a quality-control chart of the product for several days on an hourly basis. If the machines are interrupted and thoroughly examined whenever they seem to go out of limits, defects can easily be discovered.[10]

Gear manufacture lends itself readily to quality-control techniques. Recorded cases of such applications[11] show how bores were held to ±0.001 in. and sides of spur gears were aligned to ±0.005 in. Statistical quality control frequently reduced the rejection to one quarter of the initial value.

In forthcoming months, there will be a demand for ultra-high-frequency radio equipment. At these frequencies, many of the usual elements take on strange forms. Wires often become pipes. A transformer may consist of two pipes side by side. In fact, much of the equipment will be of the "trombone" variety, and manufacturers who intend to produce it will be required to extend their machine shop activities. Important is the fact that at these frequencies specified tolerances must be rigidly maintained or radio efficiency suffers. One

typical "trombone" problem involved telescoping parts. The trouble was detected by statistical methods and a more uniform product resulted with a reduction of inspection costs to a third their former value.

Bearing manufacturers have used statistical quality control methods to maintain offset values within a tolerance of ±0.002 in. The studies brought about a change from machined slots to ground slots in some cases. Gages were improved. Machine and operator performance figures were compared and improvements made.

In general, where the product comes from an automatic machine, out-of-limit values should be sought first in the gages and then in the machine, assuming of course that the work going into the machine is good. Capstan lathes, forming presses and multi-spindle automatic machines are all suitable for quality control techniques.

Method Must Be "Sold"

To initiate this type of process control it is important that the person heading the activity fully appreciate what can be done. Next, it is necessary to train (by study and experience) the statistical quality control operators who will actually do the work. At this point, it is essential that the shop foremen and supervisory help be educated and "sold" on the whole idea.

And now for a bit of applied psychology. One of the group of foremen is likely to be interested in the plan. The person heading this activity should never force his services. Instead he should place the activity where it will be most welcome and receive the best cooperation. Here it has the best chance to "make good." Its success in its initial trial will largely govern how it will be received in other departments.

In instituting the control, explain in detail to the person most directly concerned with the operation of the machine (the toolsetter, lathe hand, machine operator) how it works and how it can help produce a better product with equivalent or less effort. Sometimes the point can be put across by running the group of machines by conventional inspections and another group of machines by statistical quality control methods. This comparision run should last at least three weeks to a month. Then the result should be compared for (a) amount of waste, and (b) amount of recoverable rejects that are detected.

Today, it is often necessary to use these methods to introduce new engineering tools into a shop where the "practical" men shy away from the "unconventional." Ten years hence, one may safely anticipate that (contrary to present practice in the majority of shops) it will be unconventional *to be without* a statistical quality-control system.

It should be pointed out that all processes are not capable of being controlled initially. Some operations are so erratic as a result of machine deficiencies and operator eccentricities that it is useless to attempt a control until some of the basic difficulties are untangled and the product shows some semblance of being the result of intent rather than chance.

Much has been written on the details, theory and practice of statistical quality control. For that reason repetition here will be avoided. However, it would not be amiss to mention a few publications which offer excellent groundwork in this phase of applied engineering mathematics.

1. "Engineers' Manual of Statistical Methods" by Leslie E. Simon, John Wiley & Sons, New York, N. Y.

2. "Control Chart Method of Controlling Quality During Production," Publication Z 1.3—1942, American Standards Association, New York.

3. "Economic Control of Quality of Manufactured Products" by W. A. Shewhart, D. Van Nostrand and Company, New York, N. Y.

4. "Sampling Inspection Tables — Single and Double Sampling" H. F. Dodge and H. G. Romig, John Wiley & Sons, New York, N. Y.

5. "Sampling Statistics and Applications" by James G. Smith and Acheson J. Duncan, McGraw-Hill Publishing Co., New York, N. Y.

6. "Guide for Quality Control and Control Chart Method of Analyzing Data." Publication Z 1.1—1941, Z 1.2—1941, American Standard Association, New York, N. Y.

7. "Statistical Methods in Quality Control," by Hunter Pressed Steel Company.

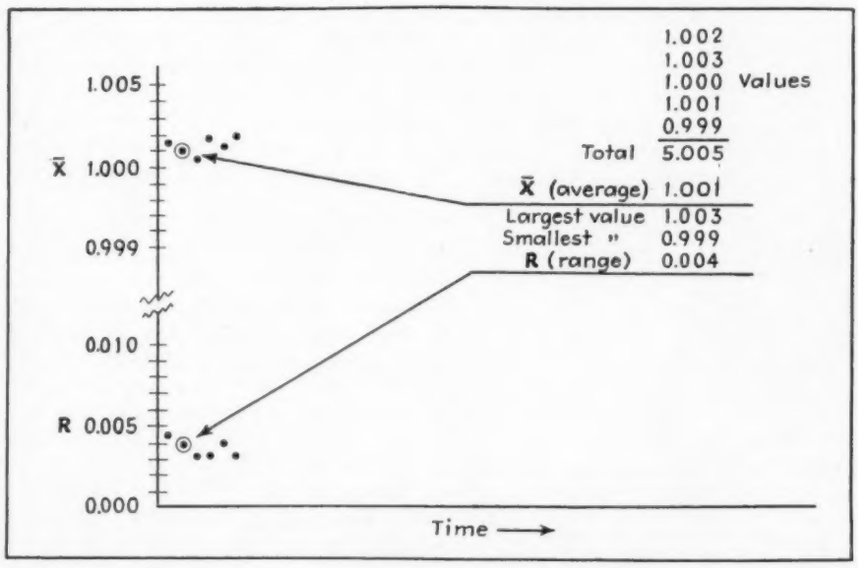
8. "Quality Through Statistics," William B. Rice, Director, Department of Statistics and Reports, Plomb Tool Company, Los Angeles.

9. "Statistical Methods in Quality Control," C. G. Stephens and J. Rutherford, Factory Maintenance and Management, Vol. 103 No. 1 January 1945, P122.

10. "Introduction of Statistical Quality Control at Illinois Testing Laboratories," James A. Fizzell, Quality Control Report No. 1, Office of Production Research & Development, War Production Board, Washington.

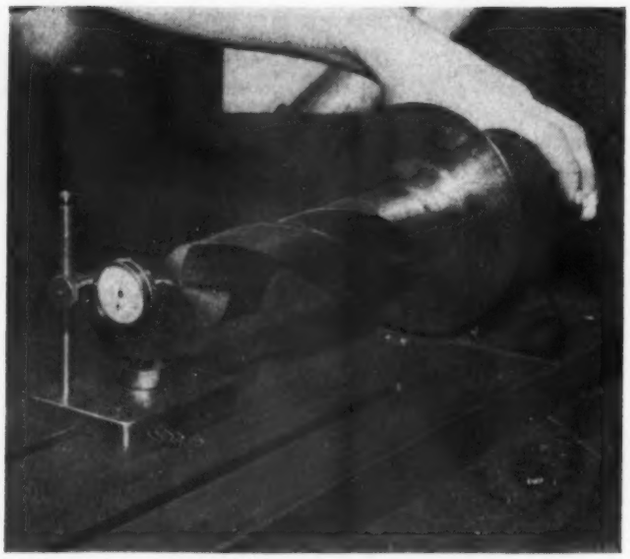
11. "Quality Control at the Lukas Harold Corporation," Carl G. Schmid, Quality Control Report 4, Office of Production research and Development, War Production Board, Washington.

12. "Application and Organization of Statistical Quality Control in a Light Engineering Plant," D. S. McNaughton. Symposium of papers on statistical quality control issued by Quality Control Panel, Birmingham District Production Committee, Ministry of Production, C.M.L. Buildings, Great Charles Street, Birmingham.



Sample computation and plotting of X and R

Drill-point clearance can be measured accurately. Shown here is a method devised to replace inaccurate protractor measurement



Indicator readings taken on the point of a drift check the clearance in a plane parallel to the axis rather than in a plane normal to the cutting lip

Official U.S. Navy Photograph

Does the Drill Point Clear?

BY W. E. AINSWORTH, MASTER MECHANIC, AND GORDON MUNRO, LEADINGMAN TOOLMAKER, CENTRAL TOOL SHOP, PUGET SOUND NAVY YARD

PRODUCTION DRILLING demands good drills, accurately ground so the two cutting edges are of the same length, the two lip angles are identical and the clearance angle on each edge increases from periphery to drill center. Freehand grinding of drills larger than ¼ in. cannot meet these exacting requirements. Only by grinding on specially designed machines and by accurate checking of dimensions can a drill be produced that will give maximum holes per sharpening.

At the Puget Sound Navy Yard, we have standardized on a drill point having a 7° clearance back of the cutting edge on each lip when measured in the conventional manner of applying a protractor at the lip corners. This angle was selected as tests showed it to be more satisfactory for drilling ship plate with portable pneumatic drills than the usual 12° clearance angle. To control the clearance accurately, we devised a dial-indicator testing method to replace measurement by protractor.

NOTE: The opinions or assertions contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the Navy Department.

Drill Clearance

A drill in use rotates about its longitudinal axis, and is fed into the material along that axis so that every part of the drill point moves ahead longitudinally at the same rate of feed. The helical curves, however, described by points on the drill lips at various distances from the center of the drill cross the axis of rotation at various angles. If a drill is ground so these helical curves lie wholly on the surface of the drill point, then the point would lie wholly against the bottom of the hole being drilled and the drill would have no clearance.

The amount of clearance a tool has is measured by the angle between the surface being cut and the surface of the tool behind the cutting edge. In the same manner, the amount of clearance on a drill point can be measured by the angle between the surface of the bottom of the hole and the surface of the drill point behind the cutting lips. The surface of the bottom of the hole being drilled lies on two helical planes, the leads of which are determined by the feed per revolution of the drill. The angle, therefore, at which the drill is ground away behind a particular point on a cutting lip should be the sum of the helix angle of the helical feed curve at that particular point plus the desired angle at which the surface behind the cutting lip should clear the helical plane at the bottom of the hole. It is thus possible to determine mathematically the shape of the drill point when the desired feed and clearance angle are known.

Measuring Drill Clearance

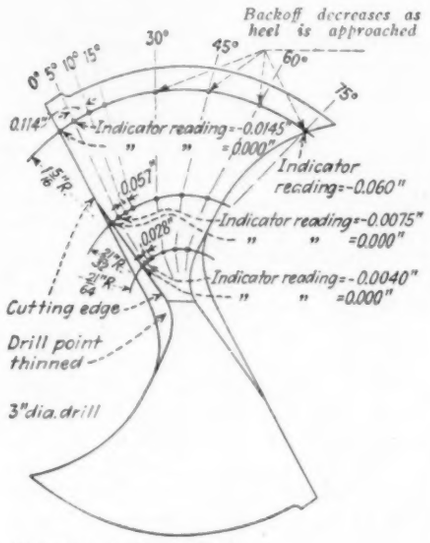
It is almost impossible to measure accurately the clearance angle of a drill with a protractor, but indicator-drop measurements can be taken on the drill at different pitch circles and at different degrees of revolution of the drill by a dial indicator drill point test gage. The gage, adjustable for any diameter of drill, consists, essentially, of a horizontal spindle in which the drill shank can be centered accurately, a circular graduated dial to indicate in degrees the amount the drill is rotated, and a base on which an indicator support is positioned.

The indicator-drop readings are taken on a 21/32-in. radius pitch circle, or on a pitch circle the radius of which is a multiple or factor of 21/32 in. It is then easy to calculate the angle of clearance from the indicator drop in 5° of drill revolution, because 0.001 in. of indicator drop in 5° of drill revolution taken at a distance of 21/32 in. from the drill center is equivalent to 1° of clearance.

As the indicator readings are taken parallel to the drill axis, the clearance angle is measured in a plane parallel to the axis rather than in a plane normal to the cutting lip. The advantage of the parallel reading is that the drill feed is in the direction of the drill axis and the amount of clearance at any point behind the cutting lip when drilling is the clearance angle at that point minus the helix angle

of the drill feed at the same point. Or vice versa, the correct indicator reading for the amount of drop in 5° of revolution is the sum of the indicator drop for the helix angle at a given rate of feed plus the drop for the desired clearance on the drill point from the helical plane at the bottom of the drilled hole.

The table shows the calculated indicator-drop readings for each 5° of revolution at various distances from the drill center for drills of different diameters used at different rates of feed per revolution. In each case, the nominal clearance angle is 7°. The rates of feed shown were chosen so that each consecutive feed is a multiple of the preceding feed rate, making each tabulation a multiple of the preceding tabulation. Similar tables can easily be formulated for different clearances and feeds. As indicated in the sketch, the back-off usually is decreased as the heel is approached on each side, as it is not necessary that the last readings drop as much as the first readings. It is necessary only that the heel clear the bottom of the hole in checking a 3-in. dia. drill.



Official U. S. Navy Sketch

Positions for making indicator-drop readings for measuring clearance on a 3-in. drill. Readings are taken on a 21/32-in. radius pitch circle or a multiple or factor of 21/32 in. to simplify calculations for each 5° of drill revolution

DRILL BACKOFF INDICATOR-DROP READINGS FOR EACH 5° OF REVOLUTION

Puget Sound Navy Yard Drill Point Test Gage

(For Clearance Angle of 7°)

⅜-in. Drill Feeding 0.0045 in. Per Revolution			
Pitch Circle Radius of Reading	21/512 in.	21/256 in.	21/128 in.
Drop for 7° Clearance Angle	0.0004375	0.0008750	0.0017500
Drop for 0.0045 in. Feed Per Rev.	0.0000625	0.0000625	0.0000625
Total Drop for Each 5° of Rev.	0.0005000	0.0009375	0.0018125
¾-in. Drill Feeding 0.009 in. Per Revolution			
Pitch Circle Radius of Reading	21/256 in.	21/128 in.	21/64 in.
Drop for 7° Clearance Angle	0.000875	0.001750	0.003500
Drop for 0.009 in. Feed Per Rev.	0.000125	0.000125	0.000125
Total Drop for Each 5° of Rev.	0.001000	0.001875	0.003625
1½-in. Drill Feeding 0.018 in. Per Revolution			
Pitch Circle Radius of Reading	21/128 in.	21/64 in.	21/32 in.
Drop for 7° Clearance Angle	0.00175	0.00350	0.00700
Drop for 0.018 in. Feed Per Rev.	0.00025	0.00025	0.00025
Total Drop for Each 5° of Rev.	0.00200	0.00375	0.00725
3-in. Drill Feeding 0.036 in. Per Revolution			
Pitch Circle Radius of Reading	21/64 in.	21/32 in.	15/16 in.
Drop for 7° Clearance Angle	0.0035	0.0070	0.0140
Drop for 0.036 in. Feed Per Rev.	0.0005	0.0005	0.0005
Total Drop for Each 5° of Rev.	0.0040	0.0075	0.0145

Note: All readings are in inches.

TIPS for Top Shop Men

112 Watch out for apple-polishers. The girl who gives you the glad eye or the fellow who brings you vegetables from his garden too regularly is going to try to collect in some way sooner or later. It's better to be safe than stuck.

113 If you're sure you can't do something—go ahead and do it at least three times. It'll help your chest expansion and calm your qualms the next time a tough one comes along. Remember: "The difficult we do at once; the impossible takes a little longer."

114 You're supposed to be an authority on everything—and you probably know you aren't. Well, neither is anybody else, even though reporters do ask a crooner about politics or a movie starlet her opinion of the American home—and usually get an answer. Pick out one or two things you are particularly interested in and bone up on them. Then, brother, you can be an authority on something! The Spanish have a saying: "In the land of the blind, One Eye is king." Americans corrupted that to: "An expert is a dub away from home," but you get the idea.

115 Build up a "kitty"—in U. S. bonds, savings account, insurance or what you will. There's nothing like a few greenbacks to improve a man's opinion of himself, and that of others in him.

116 Respect yourself—if you don't, nobody else will. Forget about what you can't do as well as things you do better.

117 For real "soaking up" of mechanical information, the group being trained should be broken into units of about three students per demonstrator. More than that means crowding, craning, and missed bits of information. Classroom instruction should be supplemented by these special "here's how" sessions.

118 Carefully avoid the impression of "hawkeye" watching of new people. Plain, straightforward helpfulness is appreciated, but steady, carping criticism "to break 'em in right" or "to show who's boss" creates nervousness in the timid and rebellion in the independent.

The Contact-Amplifier Relay

THE NEED for making a relay responsive to the most feeble electrical impulses calls for a stage of amplification between the control switch and the contactor. This is a job for the pliotron, the principal function, of which is as a "throttle valve."

If we make the anode much more positive than the cathode, the free electrons will be drawn across the tube to the anode, the anode-cathode circuit is completed, and a strong current will flow. This electron flow can be turned ON or OFF by the throttle action of the grid.

It is the nature of this tube that a small change in the voltage of the grid will have a big effect on the flow of electrons through the tube. Since the large load controlled in the anode circuit is many times greater than the feeble controlling power in the grid circuit, the result is amplification.

We connect the units in such a way that the completion of the circuit through the contact-making device "controls" the flow of current through the tube and energizes the relay. Let's analyze it a piece at a time. To make it simple, we've used batteries as the source of power. Battery B supplies the anode current when the tube is conducting, and battery C furnishes the negative grid voltage through the resistance 1R.

When the control contacts are open, the grid is more negative than the cathode. This is because the grid is connected through the resistor to the negative side of the C battery. Since there is no grid current there is no voltage drop across the resistor in spite of its high value. With the control switch open, the grid is so much more negative than the cathode that it blocks the flow of electrons from the cathode to the anode.

But, when the control contacts are closed, the resistance is connected across the battery. The grid of the tube is directly connected to the cathode, and both are at the same voltage. Now the grid no longer blocks the flow of electrons from the cathode to the anode. The tube conducts and current flows through the anode circuit, energizing the contactor coil which closes the load circuit switch and completes the external circuit.

Meanwhile, the grid circuit is drawing practically no current. And as the resistance is high, the current through the contacts is small, so there is no danger to the contact-making device.

Suppose we want the relay to make the external load circuit when the control switch contacts are open, and break the load circuit when the contacts are closed. To do that we simply place the control switch on the negative side of the battery. When the contacts are closed, the grid is connected to the negative side, and thus is much more negative than the cathode, and the tube passes no current. The external load circuit remains open. When the contacts are open, the grid comes to the same voltage as the cathode. Under this condition, the tube passes current, the contactor is energized, and the external load circuit is made.

The circuits just discussed were operated from dc. power. However, with a few minor changes we can substitute ac. for dc. in any of the electronic relay circuits.

First, in place of the batteries, we would use a transformer whose secondary windings supply the proper voltages to the anode circuit and the grid circuit. Another added feature is a capacitor across the relay coil. This is characteristic of all ac. operated electronic relay circuits.

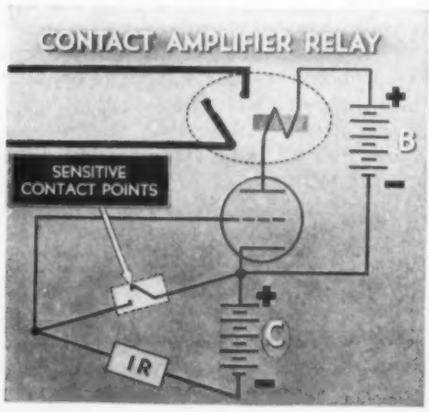
To understand the contact amplifier relay better, consider several of its interesting applications. A relay detects the slightest break in the insulation on a wire when an uncoated section completes a circuit to the conducting bath through which it runs.

Another application is a highly accurate testing machine, for determining the tensile strength of wire. It uses an electronic relay to stop its recorder when the specimen breaks. The feeble signal current, flowing through the specimen of wire under test, does not heat it appreciably or produce an arc to damage the surface.

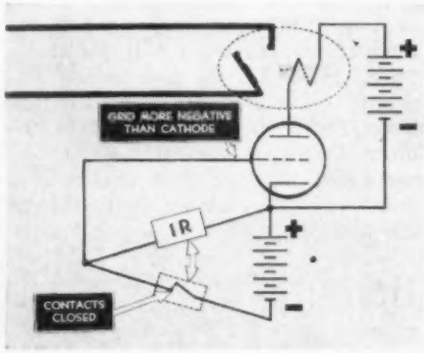
We can maintain nearly constant temperature in an induction furnace by using a contact amplifier relay. The mercury in a thermometer completes the relay input circuit when it rises to the level of the contacts. Then the relay, through an auxiliary, turns off the heater.

Our electronic relay has enormously simplified the industrial problem of the precision inspection and sorting of small parts, by making these operations almost fully automatic. Parts that are too large make contact at a certain point on the conveyor and the relay operates a solenoid which instantly rejects the part. The parts that get past this point are either just right, or too small.

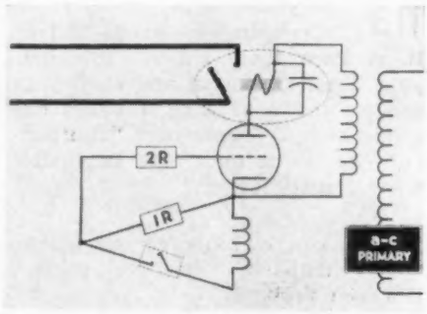
Based on a sound slidefilm in the General Electric Industrial electronics course.



The contact amplifier relay can be used with an ac. source of power



Here the external load circuit is closed when the control switch is opened



The contact-making device is connected to the grid of an electronic tube

Practical Ideas

Long-Extension Adjustable Toggle Moves Heavy Slabs Smoothly

JAMES TAYLOR

There are many for jobs on which nothing fills the bill quite like a long cabinet maker's clamp. It can be used to jack heavy slabs around and accurately into position, or to hold a small piece in place near the corner of a very thick piece when any other non-marring fastener would be unsuitable.

Most of the components to make this clamp were already available in the scrap pile, so very little work was required and the cost of material was negligible. The two hook-bars are ½ x 3-in. hot-rolled steel. The lower bar has to be planed out longitudinally to pass the locking bolt, and the upper bar requires a rectangular slot to receive the spring block; that ends the machine work. The various forks and clips can be welded or screwed on, as desired, and the clamp is complete when the links are installed with suitable pins or bolts.

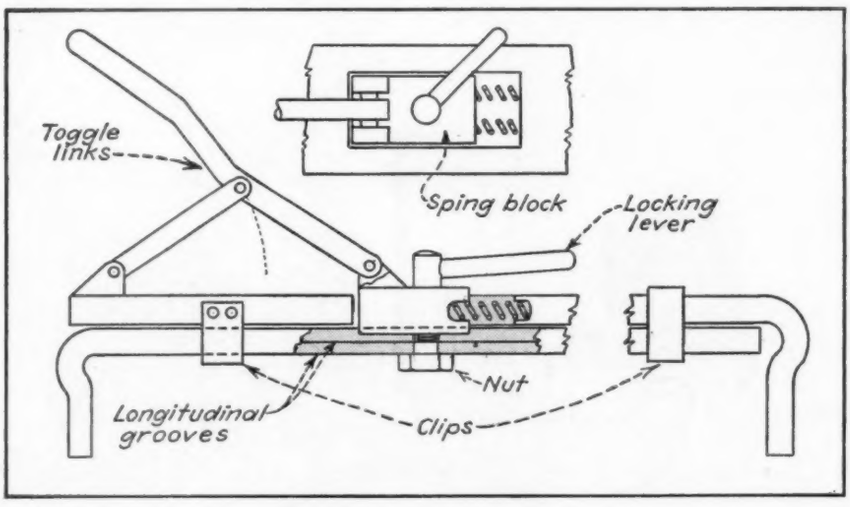
This clamp was made with 6-ft. bars so the adjustable working range is from 6 ft. closed to about 11 ft. when opened to the maximum. The clamp is adjusted by unlocking the bolt and slipping the lower bar to a point slightly greater than the desired clamped dimension. With the toggle wide open (and the spring block at the left end of its slot) clamp the locking bolt and so tie the right member of the toggle bridge rigidly to the lower bar.

Now, when the toggle is closed, the right link will push the lower member to the right and with it, pull the left hook; the left link, similarly, will pull the right hook.

Heavy blocks can be horsed around caterpillar-fashion. Hook the right end of the clamp over a convenient solid corner toward which the weight must be moved. Hook the back edge of the weight with the left end. Grasp the toggle handle with one hand and the locking lever with the other. With practically no effort, you can close the toggle, moving your load a few inches, release the bolt, open the toggle, sliding the block to the left the same distance, clamp the bolt for a new bite, and repeat until the range is exhausted. Now extend the clamp to the maximum again and find a new support.

This process can be either very fast or very sensitive. When your heavy load nears its desired location, the stroke of the toggle is reduced by setting the block away from the left end of its slots. Now, the power is magnified, and each stroke becomes so smooth that the action is almost hydraulic in its accuracy.

The springs which return the block to the left position when the toggle is tripped open may just as well be omitted in some cases although it will be handy in production setups when the clamp isn't adjusted often.



Low-cost adjustable toggle clamp moves heavy slabs around quickly and with near-hydraulic sensitivity

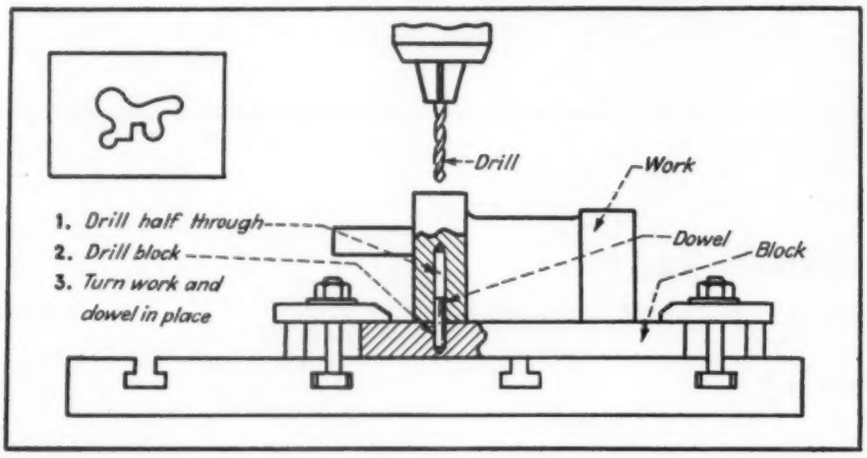
Opposed Dowel Locates Reverse Side of Hole

S. FRAMURZ

When through holes are too deep to be drilled from one face of a piece and it is necessary to turn the work over to complete the hole from the opposite face, locating the piece for the second drilling to properly align the two parts of the hole presents a problem. The method given here will give quick and accurate results.

A plate or block is clamped to the table of the drillpress (or vertical miller) and the work is placed on it and the hole drilled to about half the depth. The work is then removed and a hole is drilled in the block, without changing the setting. A close fitting dowel is next inserted in this hole and the work is turned over and its partially drilled hole is mated with the projecting part of the dowel.

The method has been found particularly useful in drilling out contours of blanking dies. (Inset). In the ab-



Dowel method assures square holes when drilling in very thick stock

sence of a contour sawing machine, openings in blanking dies are cut out by drilling a series of holes along the periphery of the contour. Holes of small diameters are preferable to minimize the subsequent chipping and filing to finish the shape. This would often necessitate drilling from both faces of the die block, and the above method could be used to advantage. It would need marking out on one face only, yet would reproduce the shape perfectly on the other face—better, in fact, than if both faces had been accurately marked out and the drilling was guided by these markings.

Contours of punches too can, of course, be drilled out similarly.

Sometimes, pairs of parts, like molds for die-castings, can be laid out to advantage using this method, because the outline of the part can be transferred to the reverse face, and thence to its mate.

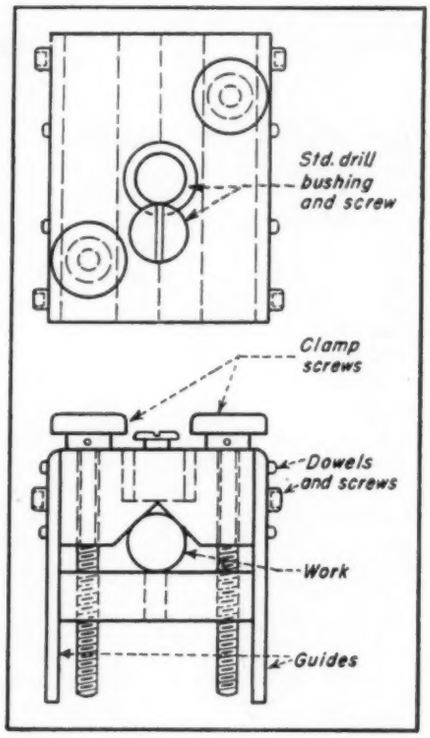
Jig Centers and Holds Round Stock for Bushing Drilling

R. BOCCIA

This V-block drill jig accommodates slip renewable bushings of several sizes and is adjustable to center and grip bar stock of various diameters. The bushings are fitted with pressed-on sleeves so that all of them will fit into one hole in the V-block. This can be done best by shrink-fitting the sleeves with still a few thousandths to go on the O. D., then one by one, mount each assembly on a good mandrel and grind the O. D. to correct size.

When the notch in the V-block has been accurately ground, all other surfaces should be carefully finished square with reference to it. Of course, the precision of the side plates or guides isn't too important for they have no influence on the work locating. But it is of prime importance to get the hole for the bushing square and centered, and to have the top surface reasonably square.

Diagonally situated knurled screws are used to draw the clamping plate upward to hold the work in the notch, and the usual screw is provided to lock the desired bushing with the flange on its sleeve.

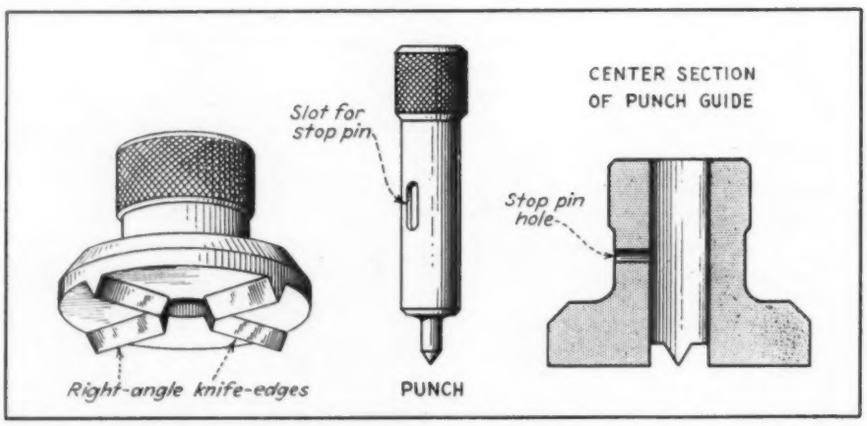


Centered bushing hole and a 90° position round work for accurate transverse drilling

Guided Center-Punch Has Crossed Knife-Edges

HOWARD C. De HEER

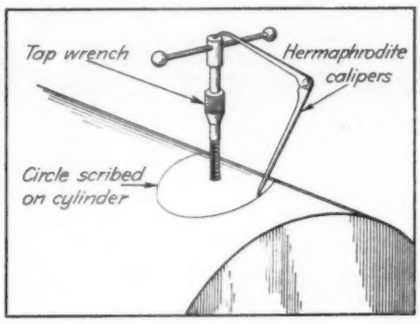
The problem of spotting holes after layout has been solved in this tool by providing it with 90° crossed knife-edges on its base. Thus, the punch is laid on the work and carefully slid along until both edges drop perceptibly into the scribed lines. The perpendicular punch has a small slot in one side so a pin through the body will prevent the pin from dropping out and damaging the lapped surface of punch or its hole, or from just plain getting lost.



Perpendicularly-guided layout punch centers itself by "engaging" in scribed layout lines

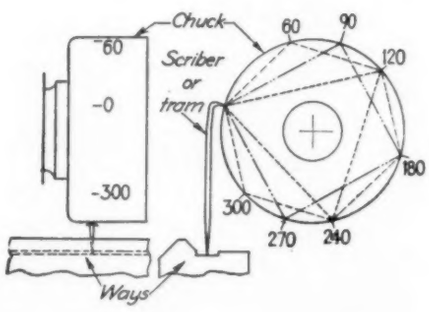
Hints on Small Tools

EARL R. GODDARD

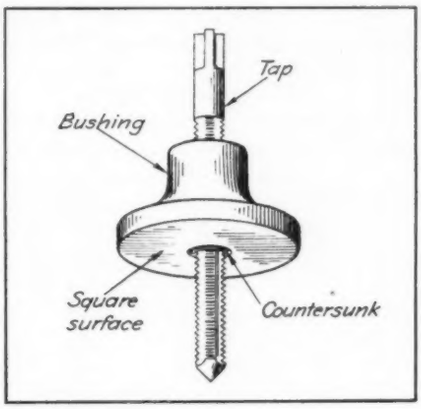


Hand Tapping Aids—To start a tap accurately plumb into a curved surface of any kind, first scribe a 5 or 6-in. circle around the point to be tapped. Next, take a pair of hermaphrodite calipers and adjust them so they touch the scribed circle at any point when the other leg is in the center hole in the head of the tap-wrench. After the tap has cut about two threads it may be well to reset the calipers for a second and final check. In making the caliper adjustments, remember that the error is multiplied by two, so set the calipers for only half the discrepancy.

I have found that perpendicular holes in flat surfaces can be tapped faster by hand with the aid of a small bushing like the one shown in sketch at right. Start the tap as usual with the bushing backed off. After one or two threads, run the bushing down to the face of the work and see whether the two surfaces meet. If not, back off the bushing, back off the tap a little, lean it a little to correct the error, start again and check again. Do not allow the bushing to lock. The bushing can be made from any material; it should be long enough to fit the tap without play and of sufficient diameter to give a good surface check.



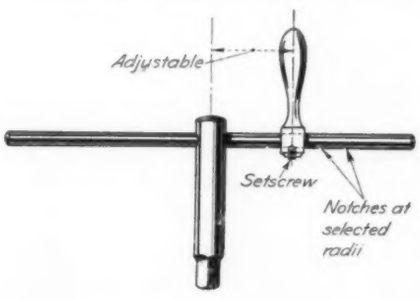
Punch for Flush Riveting—Thin parts can be riveted neatly and successfully by indenting the outside of each hole with a light blow of this punch. The displaced body-metal tends to make six double splines and when the rivet is peened into place, it grips the hole tangentially as well as axially, thus making an ideal fastening for small gear hubs, and other components which have a torsion load. The punch is made from hex stock, ground to a 50° point on all faces, and hardened.

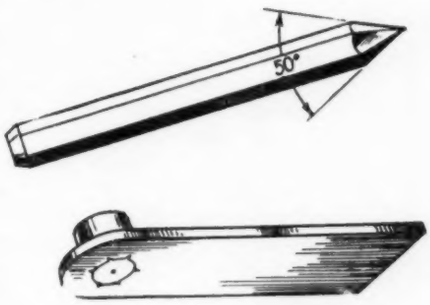


Lathe Gadgets—A spinner handle for the three or four-jaw chuck has been found handy when a lot of assorted jobs are the order of the day. Mounted approximately in the position shown, it makes the wrench into a small crank for speeding the jaws into position, then to be tightened in the can be riveted neatly and successfully usual way.

Keyways, setscrew holes and flats are quickly laid out on the lathe work when the chuck has been graduated as shown at left. A tram or a pointer on the headstock casting indicates the reference, and three, four or six equal divisions can be laid out with ease.

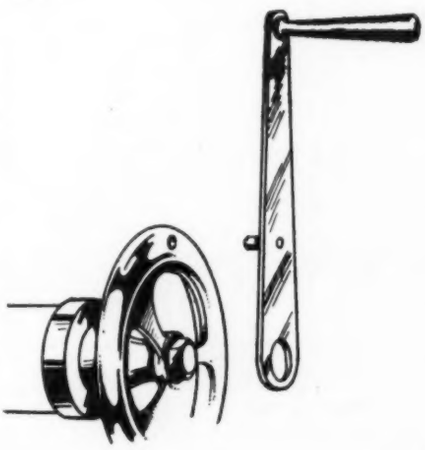
Tailstock drilling can be tiresome, when a large drill has to be fed into hard material by hand. This ⅛-in. thick extension handle can be put into action quickly and removed just as fast.





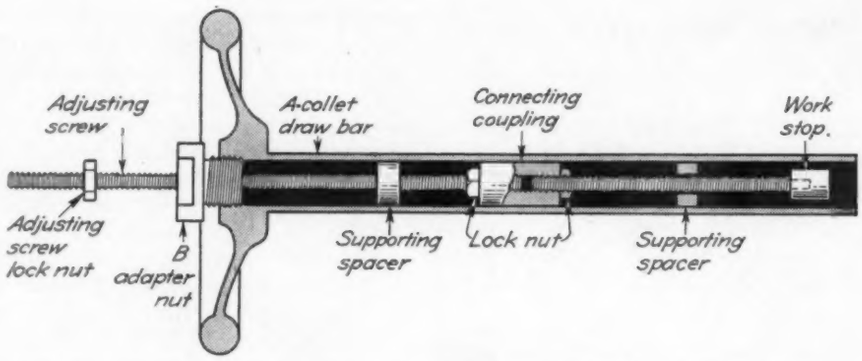
Reconditioning Ball-Check Valves—We had to reseat the ⅜-in. steel balls in some check valves. Here's how it was accomplished. A piece of 5/32-in. rod was bent into a crank. On one end we brazed a ⅜-in. ball; on the other we fitted a free-turning knob to cushion the push of the hand. The seat was reground using a fine grade of compound. In order to prevent grooving due to uneven wear on the ball, the outer end of the crank is slowly rotated in the maximum circle permitted by the ¼-in. N.P.T. hole (in this case) making about one turn for every four or five revolutions of the crank. After grinding, the valve

was thoroughly washed in solvent and a new ball fitted. The valve was placed on end with the ball resting on its seat by gravity, and struck a light blow with a hammer and pin-punch. Sucking on the other end indicated no leakage, and in service, the valves worked perfectly, holding 175 lb. pressure. Before assembling, the parts were given a light coat of oil.



Lathe Collet Stop

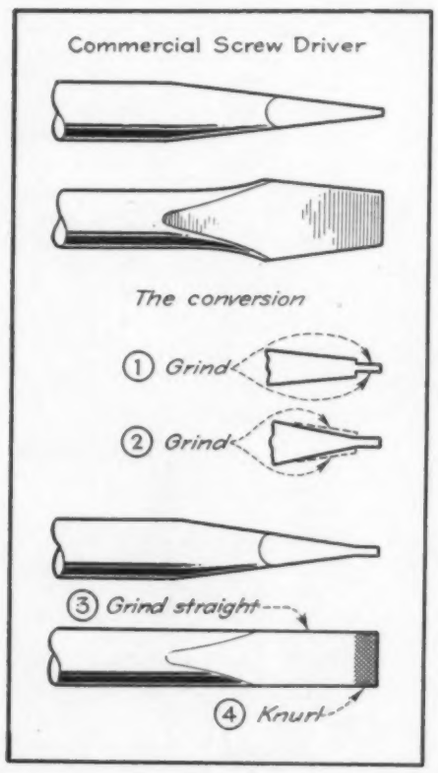
An adapter nut or bushing fitted into the tubular drawbar handwheel hub, takes a threaded rod, which is about half the length of the drawbar. Another rod of the same length can be connected with a screw-coupling to extend the range for very short work. Small spacers, fitting losely on the screw and just lightly snug in the tube, support the screws and a nut holds the adjustment. *August Quast.*



Justice For The Lowly Screwdriver

LEE L. DODDS

With great hesitance, I am daring to oppose the time-honored traditions of a host of screwdriver-makers. (Nothing personal, of course.) All sorts of gadgets have been added to the blades of screwdrivers, and they have been dolled up with the fanciest handles imaginable, but no one has made much improvement on the most important part, the blade itself. Perhaps there is no better blade-shape, but other inventors have been pooh-poohed before.



After modernizing a screwdriver in these steps, stubborn screws can be loosened without pushing

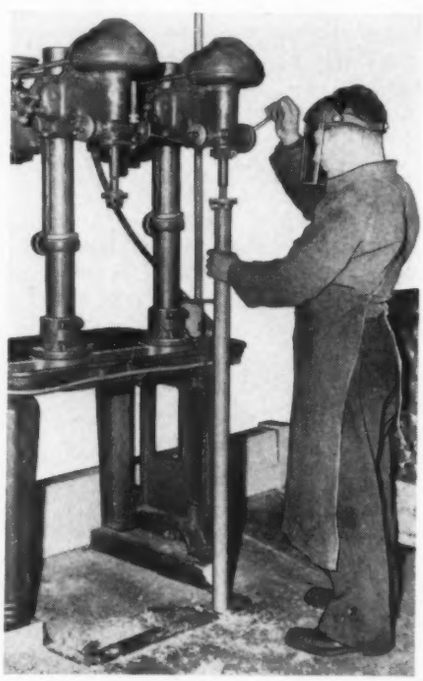
The commercial screwdriver has a perfect wedge for a blade. This is supposed to divide the torque evenly to the round or square handle, which it undoubtedly does very well, but it also fits the screw slot very poorly. Unless extreme pressure is exerted on the end of the handle, in addition to the turning effort, the blade will often climb right out of the slot, burring the notch and probably marring the work itself. That's just the taper along the surface of the blade. There is also another taper, which, very annoyingly, can prevent drivers from reaching screwheads that fit neatly into perfect counterbores.

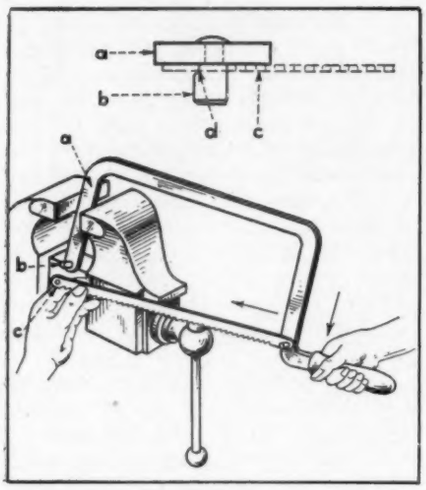
With a few minutes' careful work at a grinding wheel, a startling transformation can be wrought. The first and most important step is to make the gripping faces of the blade parallel to each other, to fit the square-slotted screwheads in a respectable way. Next, the rest of the blade faces are ground back into a smooth taper again, not only for neatness, but more to reduce the stress concentrations that are likely to form at a corner and to distribute the torque evenly. (It seems funny that removing metal can make a part stronger.) Now, grind off that squashed-out flare on the sides of the blade which prevents it from going into counterbores. If you want to be real-fancy, and practical too, the gripping surfaces of the blade can be improved by serrating them in some way. If you want to take the trouble, the temper can be drawn, and with a soft blade, knurls or file cuts can be made, and then the tool can be re-hardened. A pretty good result is obtainable with an electric needle or acid-etching, or the last grind to shape can be deliberately made on a coarse wheel. I'll guarantee that the new tool you now have will make you feel the time was well spent.

Drillpress Replaces Lathe

Counterboring the washer-seats and then spinning the ends over the washers on these tubular mast sections was a slow and expensive process on a turret lathe. As the tube had to be inserted and chucked through the lathe spindle, a large and expensive machine was tied up and at that, production was so slow that delivery schedules couldn't be met. Changing to the new drillpress method stepped up production and reduced all costs at the same time.

A floor plate, lagged to the base of a double-spindle bench-type drillpress, has a pilot under each spindle to position the mast for the two-step operation. The drillheads have been turned away from the table to accommodate these long masts. *Louis White, Westinghouse Electric Corporation, East Springfield, Mass.*





High-tension backsaw can be quickly loaded by using a vise for leverage

Emergency Hacksaw Proves Valuable Tool

S. FRAMURZ

Serviceable hacksaw frames can be made by bending steel bar stock to shape, and providing it with two pins and a handle. Fixing the blade is quick and simple and needs no tensioning screws or wing-nuts. The blade is first engaged in the pin near the handle and the frame is then momentarily held in an open vise (quite unnecessary to lock the vise) when slight pressure, downward and forward, on the frame will bend it sufficiently to enable the front end of the blade (c) to be slipped on to the other pin (b)—as shown in the sketch. Actually it takes less time to perform the operation than I have taken to describe it.

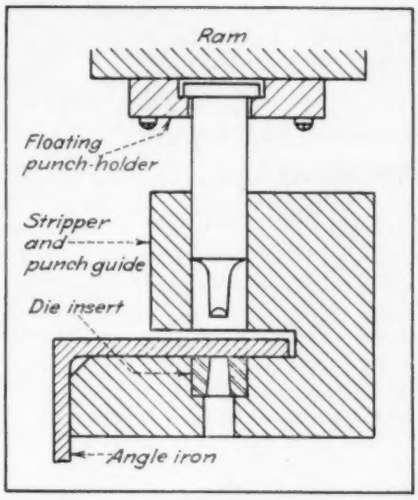
The blade is automatically brought to a fixed tension, always. This tension, of course, can be predetermined by modifying the shape of the frame (i.e., the distance between the two pins) to suit the size of the blade, once and for all. As shown in the inset, the pins are nicked at the base (d) to prevent the blade slipping off the pins accidentally.

This simplified construction can also be employed to salvage rejected frames of conventional design.

Solid Die and Stripper Solves Punch Breakage

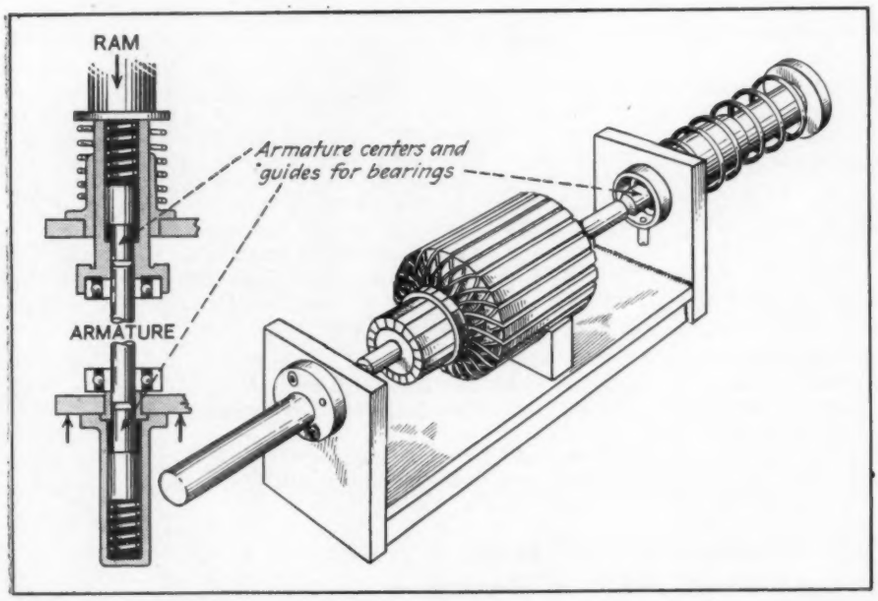
FRANK SUTZ

Simultaneous punching of 17 holes in one piece of angle iron used to give plenty of trouble from stuck and broken punches. This die holder is a solid piece. The holes are accurately located and drilled for the punch shank diameter and hardened die bushings of the same O.D. are fitted into the bottom of the hole flush with the slot. The punches are full-floating in the ram punch-holder as all guiding action is obtained in the thick stripper section of the dieholder.



Full-floating punch guided in thick stripper permits the simultaneous punching of 17 holes

The full-floating action has several advantages. It relieves the necessity for extreme precision in the ram ways; a little play won't do any harm. The punches all move simultaneously but independently so their mutual alignment, other than the initial layout, is not critical; they can't seize due to being non-parallel. A broken punch can be changed quickly and without refitting to the ram.



Bearing pressing fixture lying on the bench with armature and bearings ready for assembly. Top left, cutaway of the fixture in action: bearings have been started on the armature and the centers are partially compressed

Telescoping Centers Hold Armature For Bearing Pressing

R. W. ESAREY
Westinghouse Electric Corporation,
Lima, Ohio

Now, both armature shaft ball bearings are installed simultaneously. The fixture is laid flat on the bench, the bearings slipped over the slightly undersize centers and the armature laid in place. Its weight is supported on a semi-circular rest under the center while the spring centers are fitted in the armature ends.

The unit is then placed on end in an arbor press. When the ram is brought down, the top sleeve slides the top bearing off the center and on to the armature shaft. The lower end of the fixture holds the lower ball bearing and as the ram pushes the upper cup and uper bearing down, the centers are allowed to retract against weak spring pressure until both bearings are seated. When the

ram is retracted, the armature comes out easily and the centers and top cup return to their original positions ready for the next job.

Eccentric Rod Adjusts Chamfering Tool

H. MOORE

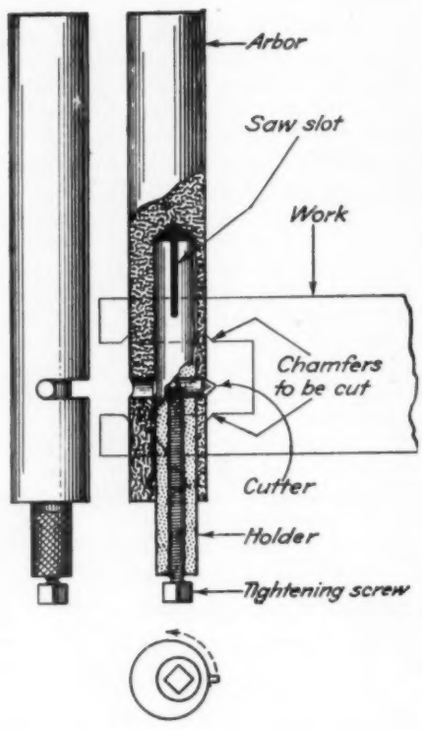
We were faced with the job of chamfering the inside edges of some clevis holes and this is the tool we made especially for that purpose. But its simple construction and probable effectiveness on many jobs seem to make the presentation worthwhile.

The principle is one which has been applied many times, that of an eccentric rod within a rod. The cutter is mounted, perpendicular to the axis of rotation, solidly within the eccentric rod and projecting through a slot in the outer bar.

This method is applicable only to through holes that are accessible from both ends because the cutter adjustment must be made from the bottom. To chamfer a hole such as this, or to cut a snap-ring groove, first grind the cutter to the desired shape and install it in the eccentric rod, through the slot. With the eccentric in the "out" position, and the tool bearing on the right end of the slot, adjust the tool to extend to the desired depth and lock it with the screw in the end of the eccentric. Now turn the eccentric until the tool is fully retracted which will be at the left end of the slot. The eccentric itself is not locked in the bar, but is a snug fit and further, the upper end is split and a slight spring action provides just enough resistance to prevent free-turning or chatter, but not to retard turning with a wrench.

When the tool is in cutting position, it is backed-up by the end of the slot, and at all times, the longitudinal position is controlled by the slot sides.

In this job, both legs of the clevis were to be chamfered at the hole, inside and out. With this tool fitted with a 45° symmetrical cutter, the top outer surface is done immediately. Without removing the bar from the work, the eccentric is turned to allow the cutter to pass through the center of the clevis (vertical downward feed) and both inside surfaces are chamfered. Again the tool is retracted, the tool fold through the lower hole and the bottom outer surface chamfered.



Chamfering the four holes in the legs of a clevis is done in a single operation with this eccentric tool

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American Machinist REFERENCE BOOK SHEET

How to Bond Sapphire to Other Materials

BY MELVIN C. CANNON, RESEARCH ENGINEER
SAPPHIRE PRODUCTS DIVISION, ELGIN NATIONAL WATCH COMPANY

MANUFACTURED SAPPHIRE, as a wear-resistant material, must often be attached to a metal base or holder, a process complicated by the properties of the material.

Dense, clear aluminum oxide, it is unusual among engineering materials in that it is mono-crystalline, hence has no grain boundaries and is not porous. It is a good electrical insulator, and resists attack by any chemical. As it is non-metallic and is not wetted by solders or brazes, it cannot be held directly with these substances. This necessitates other methods of bonding.

There are two basic methods by which sapphire may be bonded to other substances: (1) by use of an adhesive layer, and (2) by mechanical bonding. Method 1 may utilize a wide variety of organic or inorganic substances to form the cementing layer.

Method 2 involves mechanical interlocking of the surfaces being bonded. This can be achieved by use of pressure to hold the surfaces together and occurs when shrink or press fits are made or when the sapphire part is held in place by burnishing the metal over the edge of the sapphire. Solder bonding and brazing (as described below) also achieve mechanical bonding of the two surfaces. An intimate sapphire-to-metal bond can likewise be achieved with appropriate techniques for electroplating non-conducting materials.

Preparation for Bonding—Parts to be bonded to sapphire should be cleaned thoroughly before applying the cement. Removal of any oxide coating present is essential; otherwise, solvent cleaning is sufficient, with carbon tetrachloride, alcohol, acetone or gasoline applied with a clean cloth.

Organic Bonding Materials — The choice of a cementing agent for a particular application will depend on these principal factors:

1. Material to which the sapphire is to be cemented.
2. Temperature to which assembly will be ultimately exposed.
3. Whether heat and pressure can be applied during the bonding operation.
4. Stresses to which the joint will be exposed in use.
5. Subsequent exposure to fluids such as oil, cutting media and other solvents.

The most generally useful non-metallic bonding agents are the organic cements, thermosetting, thermoplastic and cold setting. There are many types in each of these groups; each has its particular advantages and disadvantages. Table I illustrates a few properties of some and will aid in the selection of the proper cementing material. Most materials will bond sapphire to any common engineering material. All have good resistance to most liquids ordinarily encountered in the shop.

Proper cementing material must be chosen with due regard for subsequent operating conditions. The nature of the work to be cemented will determine whether heat or pressure or both may be used for optimum bond strengths. After bonding has been affected, temperatures greater than that listed under "Maximum Safe Temperature in Use" in Table I should be avoided for best results. Directions furnished by the manufacturer should be followed closely for optimum results with any cement. All are resistant both to oil and water, except the last, which is resistant to oil only.

Inorganic, Non-Metallic Cements—In addition to the organic-base cements, a few inorganic cements may be used. One such cement is silver dental amalgam, a cold-setting metal alloy. Another is zinc oxychloride, made by adding 60% zinc-chloride solution to zinc-oxide powder to form a thick paste. A litharge and glycerine paste also may be used. These cements have the advantage of being cold-setting. However, they do not have the best adhesion to sapphire and depend on mechanical bonding between the cement particles and roughened surfaces. They should be used only where the sapphire is to bonded into a recess, Fig. 1.

Solder and Braze Bonds—Mechanical bonding of manufactured sapphire with soft or hard solder or brazing alloys is advantageous where an organic cement is not desirable. However, as these materials do not wet sapphire, the design (Fig. 1) must permit mechanical bonding to occur. Bond strengths averaging 1000 psi. have been obtained by this method.

In solder bonding, the metal part is first heated and tinned with excess solder, and while hot the sapphire part (which is 0.0005-0.001 in. undersize at room temperature) is put into place and the assembly cooled. The sapphire should be heated to the soldering temperature before placing into the recess.

Sapphire may be bonded in a similar manner when using silver solder or a low-temperature brazing alloy by first coating the recess with the alloy, then inserting the sapphire. At the temperatures employed in using these materials the sapphire must be heated very uniformly and handled with heated tongs to avoid cracking

METHODS OF BONDING SAPPHIRE

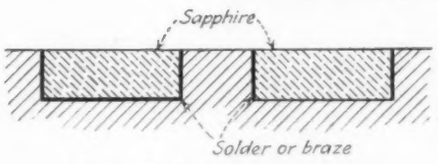

Fig. 1 - Solder or brazed bond

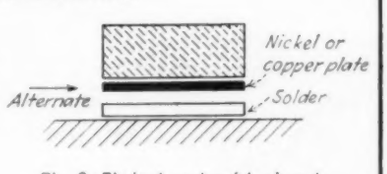

Fig. 2 - Plated and solder bond

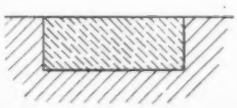

Fig. 3 - Shrink or press fit

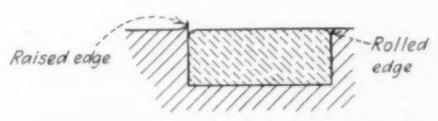

Fig. 4 - Mechanical bond

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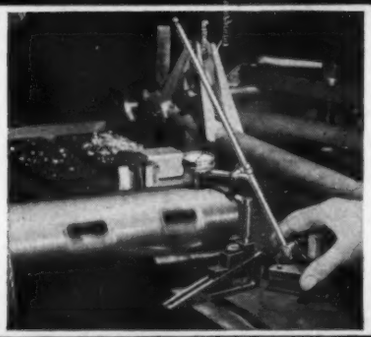

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from thermal shock. A gentle, "bushy" flame, not a sharp one, is most satisfactory on the brazing torch. A minimum amount of brazing flux should be used in the bonding operation.

Electroplating — Excellent metallic bonding has been achieved when the sapphire is first electroplated by using techniques for plating non-conducting materials. A layer of copper or nickel plate a few thousandths thick on the sapphire provides a metal layer which is firmly attached. A true solder bond can then be made between this metal coating and the piece to which it is to be fastened, Fig. 2.

Shrinking and Press Fitting—The average coefficient of expansion of sapphire is 3.2×10^{-6}/° F. and the compressive strength is 300,000 psi. These properties permit the use of standard shrinking techniques to fasten sapphire into metal bodies (Fig. 3). It is essential that both the sapphire piece and the metal recess be accurately machined to avoid localized stresses in the sapphire after fitting and cooling. Best results have been obtained by radiusing the edges of the sapphire which fit into the recess, thereby minimizing local stresses at those points. Either chilling of the sapphire or heating of the metal may be utilized in shrinking, although the latter is preferred because of the larger coefficient of expansion of the metal.

In machining the recess or hole into which the sapphire is to be shrunk, a size difference between 0.0001 and 0.0015 in. should be allowed for diameters up to ¼ in. From ¼ to ½ in. the allowance should be 0.00015 to 0.00020 in. These will permit a tight fit without danger of overstressing the sapphire and cracking it.

Mechanical locking or bonding of synthetic sapphire in metal also may be obtained by press fitting a tapered piece into a tapered hole. A taper of ¼ in. per ft. is satisfactory. Slight heating of the metal prior to forcing the sapphire part into position will give additional strength to the joint.

Other methods of holding the sapphire firmly in place, such as by the use of clamp plates and by burnishing, (Fig. 4) can be readily applied by the tool designer and machinist. In all cases physical properties of the sapphire must be considered.

In spite of the wide variety of methods developed to bond sapphire to metals, none was found to be completely satisfactory. A direct metal-to-sapphire coating which would have high bond strength and good adhesion was desirable as the metal coat could then be used as a base for soldering or brazing to metals. A research program instituted to develop such a metal coat has resulted in a very firmly held metallic layer on sapphire. It is expected that it will enable sapphire to be handled like a metal during bonding so its properties can be utilized better.

TABLE 1 — ORGANIC BONDING MATERIALS FOR SAPPHIRE

Material and Manufacturer*	**Recommended for Bonding: Pressure, psi.	**Recommended for Bonding: Temp., °F	Approx. Bond Strength, psi.	Max. Safe Temp. in use °F	Resistant to
Thermosetting Cements:					
Cycle Weld C-3 (Chrysler Corp.)	200-300	325	3000	250	Oil Water
Cycle Weld C-5 (Chrysler Corp.)	50-300	325	3500	175	Oil Water
Reanite 3615 (U. S. Stoneware)	10-500	300-400	3000	200	Oil Water
Plastilock 500 (B. F. Goodrich Co.)	50-100	250-350	3000	160	Oil Water
Thermoplastic Cements:					
Vinylseal MA28-18 (Carbide & Carbon Corp.)	200-2000	275-450	3000	150	Oil Water
Nylon Type 6-B (E. I. DuPont de Nemours)	50-300	about 450	3500	200	Oil Water
Pliobond (U. S. Plywood Corp.)	50-500	200-325	3000	150	Oil Water
Flake Shellac	0-50	210-250	1500	120	Oil Water
Bullseye Cement # 12 (modified shellac) (Zinsser Corp.)	0-50	210-250	1500	120	Oil Water
Cold-Setting Cements:					
Duco Household Cement (E. I. DuPont de Nemours)	0-50	——	300-700	120	Oil Water
Iron Glue (McCormick & Co.)	0-50	——	350	120	Oil

Notes: *This table is not intended as a complete listing of cements but gives representative data for various types. Cements of equal suitability are also available from other manufacturers.

**The manufacturer should be asked for detailed instructions for use of these cements.

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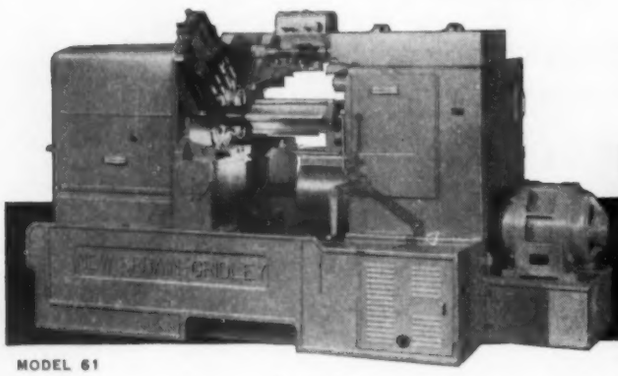

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NEWS OF METALWORKING

Materials Shortage Main Midwest Detriment to Higher Output Levels

CHICAGO—The mystery of apparently high production levels in the face of stringent material shortages has been explained by a variety of Chicago area metalworking firms. "While output totals appear high in relation to historical levels," the spokesman for International Harvester said, "they are actually low in relation to the increased facilities and capacity growing out of wartime expansion."

Most companies could hike output if more materials were available. A scarcity of workers is affecting a few companies, but overtime is being held to a minimum and every effort is being made to cut it further. Overtime runs up costs and in addition management fears that an overtime pattern, once established, will lead to renewed demands for higher pay if the overtime is eliminated.

Return to Extra Shifts

Chicago concerns are using second shifts in many cases where they were not used before, but for a particular purpose: to eliminate bottlenecks. In cases where first shifts cannot keep operations in balance, the second shift is used to clean up unfinished business so that each day starts with a clean slate.

Inventories are holding at a steady level, despite the drain of materials into production. But inventory totals today mean little, works managers point out: they are unbalanced to a dangerous extent, and contain large quantities of one material—perhaps enough for months of production—with only enough of another component to last a day or two.

Suppliers Strikes Detrimental

Harvester is having less trouble with materials than many other firms, because of CPA policies channeling castings and other items to farm equipment makers. But strikes in plants of suppliers are causing trouble. Motor truck output is running ahead of peak prewar periods, but is far less than capacity or demand.

Electro-Motive division of General Motors, along with numerous other firms, reports that forward planning for 1947 production has been hamstrung by refusal of steel mills to accept orders for early 1947 deliveries.

Chicago area steel mills say that they are three to four months behind on deliveries and that they will have to carry over 1946 orders into 1947. Therefore they will refuse advance orders until the situation clarifies.

Materials, Workers Short

Although Electro-Motive has 500 more workers employed than it had when work was resumed in April after the G. M. strike, several hundred more are needed—mostly machine operators and welders. Production is back to prestrike levels but below expectations, largely because materials are "hand to mouth" and because important suppliers—including Allis-Chalmers—are on strike. Working a 45 hour week, Electro-Motive has no plans to raise or lower working schedules.

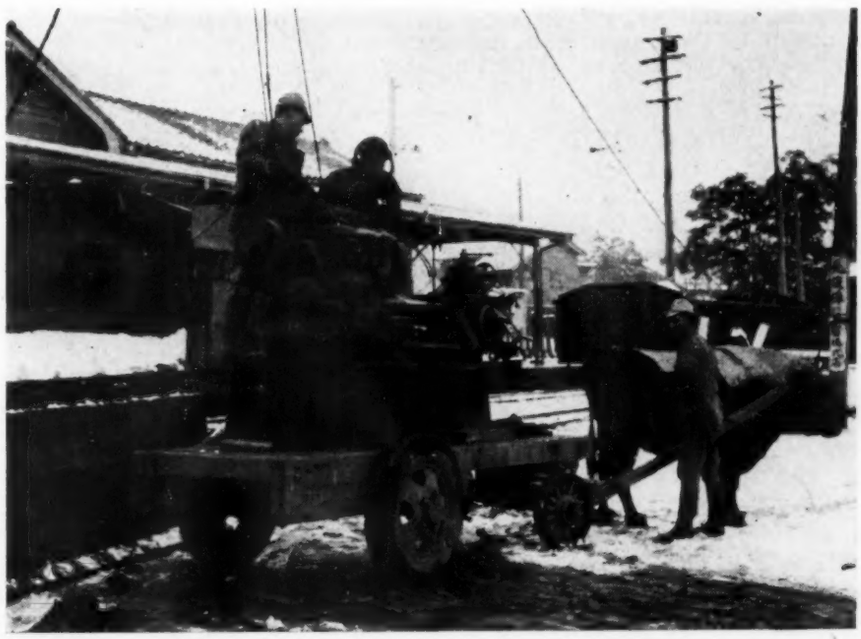
Pullman-Standard Car Manufacturing Co. is far below production capacity because materials are short. The company has enough help.

The Beloit, Wis., plant of Fairbanks, Morse & Co. needs 400 to 500 additional workers but is managing to hold down overtime. A second shift is now being lined up and eventual three shift operation is planned. A fairly high process inventory is on hand—reflecting a 5½ month shutdown—but shortage of electric motors is hampering output and the company is still in the throes of reconversion.

Buda Co. has enough labor and is working two shifts compared with one prewar. The second shift is a bottleneck trouble-shooter. Overtime is being held down. Production is good, but material inventories are dropping and castings are acutely short. The company expects better materials supply after Oct. 1.

G. E. Motor Output Up

Good news for motor users was the report of General Electric's De Kalb, Ill., plant that output of fractional horsepower units is up to several thousand a month. The new plant was leased from WAA Feb. 1 and started operations in May. When full capacity is reached the plant will be the world's largest maker of motors for domestic laundry equipment. Capacity will be attained in nine months when the payroll will hit $2,000,000 a year.



Scrap Metal Comeback—In order to help restore its damaged industry, the Japanese are making machines from scrap metal, salvaged from war plants. Here a lathe is shown being hoisted onto a flatcar from an ox-drawn cart

Gaging Business

Higher Production Possible

Although industrial production and employment is currently at peacetime peak levels, a nationwide check by AMERICAN MACHINIST correspondents indicates that such records would be exceeded if more materials and skilled workers were available. Moreover, current records are being achieved with many industries below their expanded postwar capacity, including the strike-hampered auto and farm equipment industries, the strike- and shortage-hit copper fabricating industry, the steel industry which is short of scrap, and many manufacturers of durable consumers goods short of many materials and parts.

If remaining strikes are cleared up before another wave of labor trouble develops, materials and parts shortages would ease and further production gains would be possible. An improved supply situation would permit managements to increase overtime to overcome labor shortages where such action does not increase costs prohibitively. As it is, high wage rates are holding down overtime to a minimum, serving to increase total jobs available.

Inventories Unbalanced

Although some manufacturers are better off than others on various critical materials such as sheet steel and fabricated brass, unbalanced inventories have served to cancel out such advantages. This means that production will be limited by those items shortest in supply, such as copper wire, motors, flat-rolled steel and so on. Many plants have been going ahead as far as possible with what material and parts they have, and have accumulated large numbers of unfinished units lacking certain parts. Indications now are that many production lines will have to be halted and workers laid off, until a better balance of inventories is achieved. Aside from such temporary layoffs, further increases in industrial employment are expected.

Manufacturers continue to make good use of the new light materials, such as plastics, magnesium, and aluminum as substitutes for steel and other hard-to-get metals. Current plastics capacity is over 450,000 tons annually, over four times the 1939 total. Moreover, because it is lighter, one pound of this material will replace five to seven pounds of steel. This actually means that in plastics alone, manufacturers have access to the equivalent of some 2,500,000 tons more of material than in 1939.

Although production of primary aluminum and magnesium continues below available capacity, large quantities of scrap aluminum and magnesium are being melted down into usable form and shipped to manufacturers.

Machine Tool Outlook

Machine tool production this year is estimated at $350,000,000, which compares with $185,000,000 in 1929, the best prewar year. If higher costs and prices are taken into consideration, the number of units to be produced in 1946 will be about 30% more than in 1929. The point is that the industry is on its way back to prewar levels in physical output if not in dollar volume. Current shipments have been running at a rate of about $28,000,000 a month at the lower prices. Only a small percentage of builders, however, have taken full advantage of the 20% increase in ceiling prices granted in April.

There is a strong competitive bidding for available business—by builders of different types of machines, by companies making the same type of machines, and surplus machine distributors. The machine tool industry is estimated to be operating at around 50% of its present capacity, after allowance is made for withdrawal of a large part of the war capacity through sale of DPC factories and diversion of facilities to other products.

July Shipments Down

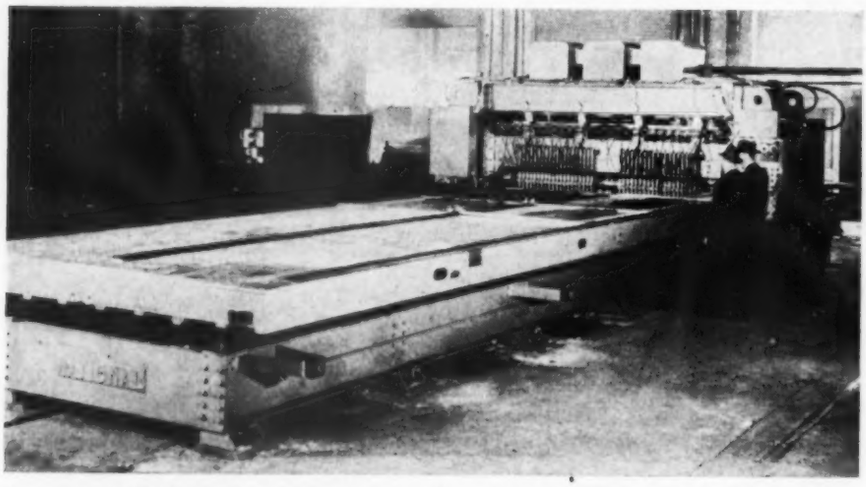
July vacations for employees plus labor difficulties in a number of tool builders' plants reduced that month's shipments by about 25% from the June total, according to the National Machine Tool Builders Association. Preliminary figures indicated July shipments at around $21,000,000, as compared with June's total of $28,500,000. Foreign shipments made up 25% of the July total and 24% of the June shipments.

New orders for July were about $27,000,000 (despite higher prices in June) as compared to June's $28,000,000. With estimated July cancellations at $2,500,000, as compared with June's $1,600,000, the industry's backlog at the end of July slipped to $180,000,000 from June's $183,000,000.

INTERNATIONAL DETROLA BUYS ANDREWS STEEL

CINCINNATI — International Detrola, whose offices in Detroit supervise activities of ten major and subsidiary manufacturing operations in varied fields, has moved into a new sphere of operations with purchase of the Andrews Steel Co. in the Cincinnati area.

The purchase gives Detrola a source of sheet steel for its refrigeration and air conditioning equipment up to 180,000 tons of hot-rolled yearly. However, Detrola will use very little of this for the present, as evidenced by its reassurance to Andrews customers that their requirements will continue to be met. This move to protect a raw material source is somewhat in line with recent action taken by Kaiser-Frazer Corp. in buying the Portsmouth Steel works of Wheeling Steel.



Increased Welding Production—Production is expected to be increased about 30 times following the installation of the huge multiple spot welding machine, shown above, in the Chicago plant of the Pullman-Standard Car Manufacturing Co. The machine will be used mainly to weld "stiffeners" to the interior of car sides, giving them a sleek streamliner appearance

Detroit Letter

Contingencies Feared

A continuing increase in finger-crossing is significant today as Detroit auto producers and their suppliers look toward the future. Expectations continue good, and there is no pessimism of consequence in the air. But as week follows week and production continues to jog along in low ground—as supply problems fail to show signs of any loosening of consequence—as labor problems remain a worry, if not an active threat of the moment—top company executives are gearing themselves to be prepared for contingencies.

An enlarging concern is being expressed, and some publicly, over the actual size of the consumer goods market. It is no secret that large quantities of duplicate orders have been placed for automobiles, home appliances, and other bulky items which comprise the backbone of the nation's backlog of demand for goods. The question is being asked how long this backlog can be maintained, dotted with duplications as it is, when production skims off the top of the order books. One balancing factor, of course, is that large numbers of buyers have not placed orders, but are waiting until they can shop and compare, and then get the delivery they want in reasonably short order.

Machine Tool Orders Taper

Machine tool ordering has tapered very modestly, it would appear. The volume of requirements for the 1948 models to be introduced within the coming 12 or 14 months seems to be somewhat less than was earlier anticipated.

On top of that, there have been a few cancellations. One major engine revamping program on the part of one of the largest producers seems to have been shelved for at least a year. The reasoning appears to be that the expense of retooling to make an entirely new block probably does not justify the improvement which will result therefrom. If business continues good, in a word, the demand for cars will not be contingent on any such under-the-hood revision; and if it goes into a slump, the change will not stimulate it notably.

This may be typical of the sort of hedging, crossed-fingers attitude referred to. It might be noted in this respect that on major machine orders, requiring eight or ten month delivery, the fact that orders are on equipment makers' books today is not necessarily all-inclusive. One large builder estimated recently that today's conditions could make it possible to cancel some of the complicated orders of this sort in 90 days or so without incurring much more than 5% or so of total cost in cancellation charge. This holds true, of course, only where work is backed up far enough to result in delays in getting started at this time.

Meanwhile, orders for light car tooling continue to pop up here and there. One other company seems to be moving into the field, in addition to Ford and Chevrolet. The company is not Plymouth—about whose silence in the face of the preparations of its competitors there is much curiosity.

Inventories Unbalanced

Inventory positions in Detroit continue mostly mixed. Some concerns have had to enlarge their stockrooms in recent months to handle the increased quantities of materials on hand—but they remain short of so many items that manufacturing continued hand-to-mouth. The general attitude is that materials, parts and tools must be bought in quantity whenever the opportunity arises, because they may not be available tomorrow. This realistic attitude, quite obviously, does not help clear up current shortages. The idea is manifestly impossible, but some sort of clearinghouse pool on short-term inventory surpluses might go a long way toward solving the short-term shortages.

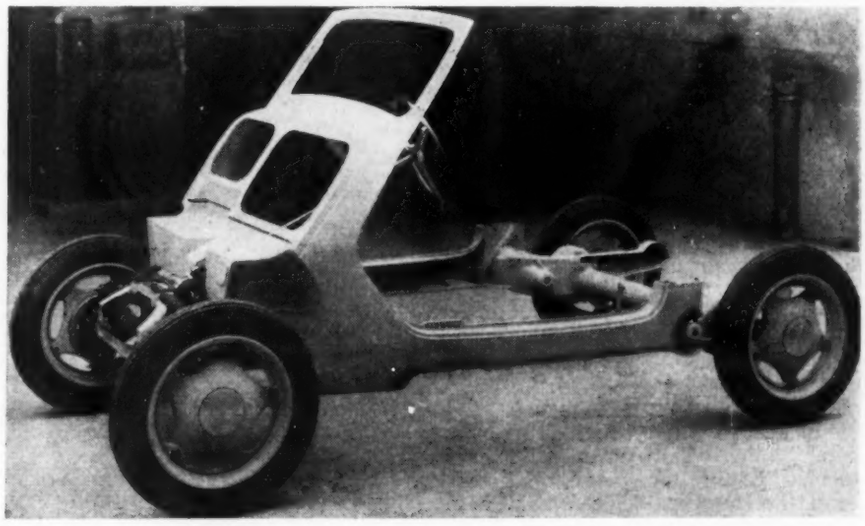
Management realizes that these shortages are resulting in notably higher production costs. Stop-and-go assembly lines are an obvious factor. But behind them is the devotion of personnel and time to materials and parts chasing, the same role played by expeditors during the war. The number of employes on non-productive functions of this sort is far larger than in any earlier peacetime period.

Typical of this picture is the remark of a top machine company executive recently: "I wouldn't be surprised if we could get just as much work out in 32 hours as our present 40, providing we were getting requirements into the plant when we wanted them, on time." This same man then vouchsafed the opinion that today's production lags might well be more responsible for higher costs than even wage rates or inefficiency.

Ford Decentralizes Buying

Ford Motor Co. has taken a noteworthy step in decentralizing its purchasing department, another step along the way which was begun about two years ago. At that time purchasing at River Rouge was opened out to the extent that virtually each plant or separate building did a good share of its own buying. That tendency diminished, however, until now, when purchasing agents in 13 assembly branches throughout the country have been authorized to do their own local buying, to fill needs for maintenance, repairs, and general stores items. Some $10,000,000 in purchases will probably be made annually out of these new sources.

There are several reasons behind the move. One is to relieve the burden on River Rouge, where most of such buys were formerly made. Another is to develop new sources and afford closer contact with them. The entire concept ties with one Ford idea of spending money at the points where it centralizes its sales in the field.



French Aluminum Car for U. S.—Versatile Henry Kaiser has purchased the American rights to this "Gregoire" car, made in France. With a cast aluminum body, the vehicle weighs only 800 lbs. The wheels have "spokes" which are part of the hub and not the wheel; the car has a front-wheel drive, powered by an air-cooled, horizontally opposed flat twin-engine and travels 65 mi. on a gallon of gas

Nonferrous Metal Supplies Short; Prices Rising, Imports Uncertain

WASHINGTON — Heavy expenditure of American mineral resources has left a problem far more complex than the gearing of metal economy to war. The current metal situation is a picture of shortages, price confusion, and greater dependence on foreign sources.

The world lead shortage of 500,000 tons per year is a famine that will pinch manufacturers of machinery, autos, cable, plumbing, for two years or more, at inevitable higher prices.

Ceiling price of primary lead was upped June 3 from 6.25c to 8.25c, and during price holiday went to 9.5c. Now it's back at ceiling and OPA says producers want to be bailed out with another raise, which will be denied, probably in an early announcement, saying ceiling and premium are enough. CAA admits producers are withholding for higher prices.

Lead Supply Down

Metals Reserve has 38,000 tons of lead, has already borrowed 6000 tons over release quota which must be paid back. Imports are 7500 tons per month, at 9.5c, the difference above ceiling being a subsidy to foreign sellers.

Because of labor shortage, strikes and depleted mines, domestic production dropped from 470,517 tons in 1941 to 388,494 in 1945, secondary recovery declining with mining.

Copper Price at 14⅜c

Not one, but two two-price dilemmas in copper resulted from raising the ceiling 2-2/8c for mines that had granted approved wage increases. Because nearly all the industry now has settled their wage issues OPA has granted the higher price of 14⅜c to all.

The other twin price in copper stems from the "10-X" joker in the new price law, requiring that the ceilings on important imports, including lead, copper, tin, zinc, be removed or raised to world level. Dr. John Steelman, OWMR chief, thinks he got around that one by reading the text to mean only goods of which a very large proportion are imported, and by showing that imports will continue regardless of price.

Copper Imports Off

Foreign suppliers are holding new copper contracts down to three months, hoping for prices still higher than the current 15.75c which, with charges, adds up to 16.5c on U. S. docks. Even on contracts in force, some of them have "trouble" making shipments. Although the Chilean strike has been settled, strikes have now hit Rhodesian mines.

Due to strikes the chief shortage in copper is cast shapes, such as wire bars, which are now allocated direct to big refineries, which are agents. Any user can buy all the copper he wants, but inventory controls aim to prevent excesses.

Copper supplies will improve gradually from now on. Pipe lines have to be filled; it takes 60 days to build up a cathode of electrolytic metal; much imported copper has to be refined and recast into suitable shapes.

Metals Reserve had about 325,000 tons of copper in July, and is releasing 75,000-80,000 per month. Domestic production is 65,000 tons, consumption 100,000-120,000 tons.

Tin Output Curtailed

World tin production will not attain pre-war levels till some time in 1949, John Croston, CPA's able authority, predicts. He has just surveyed the Orient and found only 41,000 tons there, exploding the story that Japan was in heavy production during the war. Far Eastern mines will produce only 24,000 tons in 1946, compared with 160,000 in peacetime.

Deliveries from Belgian Congo stopped, either because Belgium is conserving, or using it herself. Siam's king was assassinated, and new contracts have to be written. U. S. has recognized the new Bolivian government, and report is due on a new deal there. Patino handles half of Bolivia's production, which goes to Britain normally, U. S. taking the non-Patino half. Netherlands East Indies workers, having sampled Yankee money, want higher wages; the country has political trouble, having been disrupted by the Japs. Those are some of Metals Reserve's troubles.

Major drain on tin supply is 136,000 tons allocated for export in fourth quarter, 24,000 tons more than in the third, to countries packing food in cans for starving Europe and Asia. But CPA's order channeling 85% of tin mill products into food closures probably will not be continued through the fourth quarter. And, CPA has increased by 10% the allocation of pig tin to using manufacturers, with expected favorable effect on automotive bearings.

Zinc Least Critical

Zinc, under an 8.25c ceiling, is hoping for an increase, and unlikely to get it, because complaints to the government about supplies nowhere match the noise about lead, copper, and tin.

Flat-rolled Steel Capacity 17,000,000 Tons; Auto Makers Take Usual Share

NEW YORK—Present annual capacity of the steel industry for hot-rolled sheet and strip is estimated at some 17,000,000 tons, according to informed industry sources. This is about 1,000,000 tons greater than in the 1941 record year for such flat-rolled production. Industry observers feel confident that this capacity, plus the 2,500,000-ton capacity of mills now under construction, will make possible the meeting of foreseeable requirements for these steel products, once the present backlog is whittled down a bit and order duplication is shaken out.

Auto Industry Takes 43%

According to the American Iron & Steel Institute, the new mills now under construction will be completed by July, 1947. This indicates that next year's production of flat-rolled products may come to some 18,000,000 tons, barring unforseen labor difficulties. If the auto industry should make six million cars and trucks next year, it would call for about 44% of flat-rolled steel production, as compared with the 43% it used in 1937. However, increased use of aluminum, magnesium, and plastics in auto production could reduce flat-rolled steel requirements of the auto makers. At present, the average car requires 2,715 pounds of sheet and strip, including allowance for replacement parts.

Manufacturers of various consumer durable goods, also large takers of flat-rolled steel, have been trying to replenish inventories depleted during the steel strike, besides trying to keep plants operating currently. Delivery uncertainties have resulted in the placing of many duplicate orders, with the probability that much of the tonnage on mill order books now will be cancelled by the year-end.

Steel Activity High

Steel activity is expected to continue over 90% of capacity, despite the scrap shortage, as mills use more pig iron in their melt. However, this development has hit the merchant iron supply of foundries, which are forced to seek cast grades of scrap more aggressively. Price uncertainty is reported to be holding up some sizable shipments of scrap, with dealers now seeking a $3.50-a-ton increase. This would mean about $1.20-a-ton more for finished steel. Government aid to ease the shortage and possible price action on scrap would push steel operations closer to 95% of capacity, if successful, it is said.

Washington Bulletin

Surpluses Still Large

Announcement by Robert M. Littlejohn, WAA Administrator, that he hopes to close out his stocks of war surplus, excepting leases and loans and remnants, by next July, sounds over-optimistic to most informed persons. In two years WAA has unloaded only about $5 billion in surplus, has around $25 billion still to go. A big item of leftovers by next July is likely to be unwanted machine tools. WAA's expert subordinates admit that machinery is moving slowly. In one type alone they have 3000 units unsold, and not selling. One way out is for Army and Navy to pull back a lot of machines, which by then might be justified by a tenser international situation.

Navy is cockier than ever, since Congress left the armed forces merger bill unpassed. Latest Navy move is to set up an independent research organization, which will duplicate and overlap several other federal laboratories. Atomic destruction of ships at Bikini, instead of depressing Navy's military standing, gives it an opportunity to build a new fleet. The merger bill will die with the 79th Congress, and the whole controversy will rise again to plague the 80th, with Navy opposition grown stronger with rest.

Japanese Output Cut

Far Eastern Commission has agreed that American Military Government shall take over about 500 Japanese factories. Steel production will be cut from 5 million tons to 3.5, pig iron from 4 to 2 million, ball and roller bearings cut 90%. Machine tool industry will be 50% dismantled, leaving 27,000 new machine tools per year, which is three times Japan's actual need, according to the "Wall Street Journal's" Tokyo correspondent. Shipbuilding will be cut from 1,500,000 tons annually to about 150,000 tons. AMG will rigidly control six Japanese industries and nearly destroy six others, with intent of frustrating any war effort.

Big Surplus Deals

Biggest junk deal ever heard of was on when War Assets received 150 bids for 21,000 tactical airplanes that cost $3,900,000,000 now in five storage lots throughout the country. Successful bidders will pay 10% down, balance during operations. They will sell aluminum, copper, rubber, instruments, electric motors (mostly odd voltage) and parts which, with ingenuity, can be fitted to other purposes. This deal nearly completes salvage of combat types, which are obsolete for war and useless for other flying.

War Assets was preparing, as this was written, to advertise about $75,000,000 worth of metals and metal products, to alleviate the shortage. Most of the goods will be offered in six major industrial regions. Among the items are alloy steel billet bars, pipe and tubing, aluminum sheet, rod and tubing, aluminum scrap such as castings, tool steel, battery plates. Most sales will be on fixed prices, a few bids. Usual priorities will apply.

Decontrol Action

Machine tool and other industrial equipment groups are preparing an early approach to OPA for decontrol of price ceilings on categories still covered. Officials participating in the effort say that about 80% of heavy equipment is under suspension—they want to free the other 20% and practically all light stuff, including machine tools. They will present their economic data to OPA's decontrol section. If denied, in part or entirely, they will go to the Decontrol Board, one of whose functions is handling appeals from OPA.

Soon as the new three-man Price Decontrol Board acts on farm produce and other business backed by strong pressure groups, observers believe the machine tool and other equipment industries will call for removal of ceilings, still remaining after the second decontrol order, which covered tools over 2000 lbs.

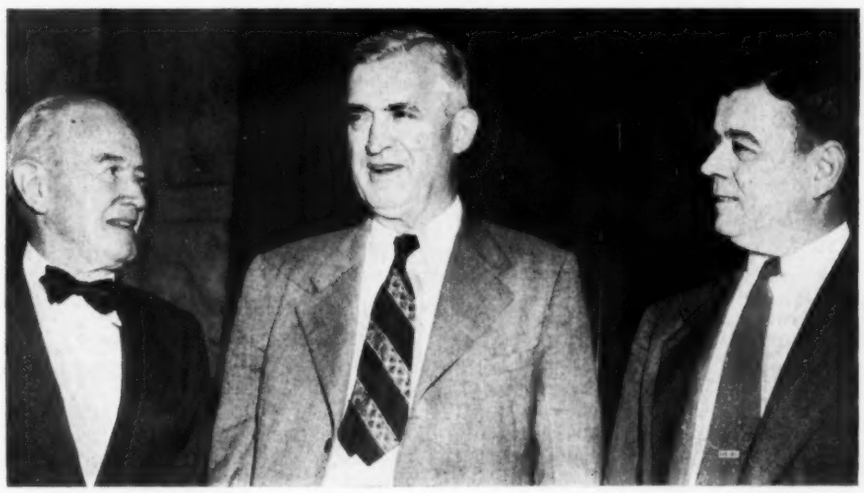
IOWA STATE TO HOLD QUALITY CONTROL COURSE

IOWA CITY, IOWA—An intensive 10-day course in "Quality Control by Statistical Methods" will be given at the State University of Iowa from October 15-25 inclusive, making it the fourth such course given since October, 1944. The course covers conferences, lectures, and laboratory periods. Those interested should write either to Prof. E. L. Waterman, College of Engineering, or Prof. L. A. Knowler, Department of Mathematics, University of Iowa, Iowa City, Iowa.

Aluminum, Steel Developments

Henry Kaiser isn't frozen out of aluminum by RFC's assignment of the Hurricane Creek, Ark., bauxite stockpile to Reynolds Metal. Instead, he has instigated a State Department exploration for high grade bauxite on Tarawa, Guam, and other Pacific islands. A rich discovery would aid Kaiser's dream of a west coast aluminum industry. He is readying his Baton Rouge alumina plant to process ores from South America. If the Pacific pans good bauxite, he would move the Baton Rouge plant to a northwest dock, within easy reach of his aluminum plant and rolling mill in the Columbia valley.

Normal operation of CC ratings on iron castings and steel, suspended during the steel strike, have been restored by CPA, effective August 7. Applications go on form CPA 541-A. It is expected finished steel fabrication may reach normal in fourth quarter. CPA will not let you refer to the CC restoration as "allocation."



Decontrol Board Meets—The difficult assignment of determining current prices for commodities and when they should be released from the control list has been handed to the three men pictured. In the usual order are: George H. Mead, Dayton paper manufacturer; Roy L. Thompson, chairman of the group and president of the Federal Land Bank, New Orleans; and Daniel W. Bell, former Undersecretary of Treasury and president of American Security and Trust Co., Wash.

Labor Shortage Spotty; Better Material Flow Will Intensify Manpower Lack

WASHINGTON—The labor shortage today is spotty, rather than overall, and is expected to become worse by late fall when more materials flowing into the plants of fabricators will create a need for more workers.

The problem isn't one of worker scarcity, because in July there were 2,270,000 unemployed, compared with only 830,000 without jobs shortly before V-J Day. Rather, it is one of having workers with the proper skills in the areas where they are needed and willing to take the jobs available. Often this requires additional housing, transportation and other services which cannot be provided.

Peak Employment

The U. S. Employment Service will not hazard a guess of what labor needs will be, although its director, Robert C. Goodwin, sees a "definite trend" toward a manpower shortage of the wartime type. Employment in July is reported by the Census Bureau to have reached an all-time peak of 58,130,000 which is 1,400,000 above June and 4,000,000 above a year ago. Counting 2,640,000 in the armed forces, employment is above the 60,000,000 predicted by Secretary of Commerce Henry A. Wallace, but below the wartime "labor force" of over 64,000,000 including members of the armed forces.

In most industries the serious shortage is that of materials rather than labor. The labor needs will become critical as materials become plentiful. This is particularly true in automobiles, general foundries, steel and construction.

Metalworking Labor Shortages

The same is not true in cast iron and soil pipe foundries, where the Civilian Production Administration has taken steps to feed them pig iron, scrap and coke in order to clear one of the housing bottlenecks. Here there is a distinct scarcity of molders and common laborers.

In the non-ferrous metal mines, whose production has been hard hit by strikes, there is a scarcity of men willing to take mining employment. Moreover, the mine operators are becoming more selective and are less inclined than they were during the war to hire many unskilled hands.

Employers may or may not find tool and die makers, depending on the area and the type of work. In Providence, R. I., for instance, they were available for general work, but not for the special work required in the watch industry.

Migration of workers is confined largely to the shifting of farmers into mines and foundries during the off-season.

Training Stepped Up

Government-sponsored training programs have stepped up considerably and may help soften the labor market. More than 400,000 veterans are participating in on-the-job training and it is expected that there will be 700,000 by next June. In the building trades the number of establishments participating in the apprenticeship program rose from 49,000 to 60,000 during July. Greater utilization of handicapped workers will also help.

AAF TO MAKE 100 EXPERIMENTAL ROCKETS

WASHINGTON—Army Air Forces will construct about 100 rockets capable of reaching 20-130 miles elevation. Some will be fired in the autumn of 1947. Within five years, AAF hopes to send rockets 500 miles up, which is calculated to be maximum layer of thinnest atmosphere. All experiments will use instruments for the collection of data on the stratosphere. The instruments will be ejected and let down by parachutes.

AAF hopes eventually that men can ride the missiles outside of the atmosphere. No sound predictions are available on human interstellar flight. Army and Navy are considering an effort to send instrumented rockets to the moon. Initial experiments began at White Sands, N. M., on August 22, using obsolete German V-2 rockets, which can reach 90-100 miles elevation. Thin-winged airplanes are expected to reach supersonic speeds of 1000 to 3000 m.p.h., at first carrying only pilot and mail, within two or three years.

STEVENS OFFERS NIGHT COURSE IN METALLURGY

HOBOKEN, N. J.—The industries Training School of Stevens Institute of Technology has included in its curriculum a three year program leading to a diploma in the field of metallurgy. The new program will include metallurgy of non-ferrous metals, metallurgy of steel, and two courses in powder-metallurgy. Students may take night instruction in this course. Fall session opens September 30.

WAA Establishes Metalworking Group for Surplus Equipment

WASHINGTON—War Assets Administration has established a National Committee on metalworking machinery and equipment, to stimulate sales of this type of surplus property needed for industrial reconversion.

Similar committees will be established in each of WAA's 33 regional offices to serve in an advisory capacity.

The national committee is representative of the contract dealers as to size, geographic location, membership in trade organization and the three segments—manufacturers, dealers in used machinery and equipment and dealers in new machinery and equipment. The regional committee will be formed on the same pattern as the national committee.

The functions of the committees will be to discuss and make recommendations concerning all aspects of problems relating to increasing the volume of sales. Conclusions and recommendations of the meetings will be studied by the Metalworking Equipment Sales Division of WAA with a view of applying them to disposal problems.

Carrier, Syracuse Share Plant

SYRACUSE, N. Y.—War Assets Administration has authorized the Carrier Corp., and Syracuse University to share the huge Thompson Road plant here. Under the agreement, Carrier will pay $4,000,000 on a 10-year basis and will come into possession of a big segment of the plant used by General Electric Corp. as a turbine generator plant during the war. Carrier plans to manufacture large refrigeration equipment in the plant.

ASA Recommends Proposal

NEW YORK—The Mechanical Standards Committee of the American Standards Association, which met July 17 to consider the proposed new ASA project, a numbering system for identifying anti-friction bearings, has decided to recommend to the Standards Council of ASA that the project be undertaken under the sectional committee method and that sponsorship be assigned to ASA's Mechanical Standards Committee.

The recommendations of the Mechanical Standards Committee are now being submitted to the ASA's Standards Council for its recommendation. The Standards Council includes in its membership representatives of the machine tool builders, the auto industry, bearings manufacturers, and others concerned with this matter.

All Machine Tool Builders Not Booked with Capacity Orders

CLEVELAND—An indication that not all of the machine tool builders are too well fortified with orders for new machines came to the attention of Cleveland machine tool dealers August 12 in a letter from a machine tool manufacturer in the New England district, informing them that the company was in a position to do a job of rebuilding their own products for customers on a fixed price basis.

It was the first instance of this kind that has come to the attention of the Cleveland dealers since the poverty days before the tooling up job for war started.

Complete Overhaul Job

According to the price scale attached to the solicitation letter, a flat charge will be made by the company for a complete job of overhauling, cleaning, replacing of worn parts, and the machine returned to the owner with a new guarantee from the manufacturer.

A similar plan was instituted several years ago by an eastern machine tool builder when he found his backlog of orders had disappeared. At that time the manufacturer found the plan worked well, so well in fact that the builder found himself unable to house the deluge of tools that were returned to him for rebuilding. The real harvest came later when, after dismantling a machine and finding it beyond rebuilding, representatives found little difficulty in replacing the worn-out tool with a brand new one.

72 Suppliers Strikes Curtail General Motors' Production

DETROIT—Up through August 14, 72 suppliers strikes were affecting General Motors divisions; 57 of the labor disturbances being in the United States and 15 in Canada. Of the total, the strikes have lasted varying lengths, with 27 prolonged more than 60 days, 33 lasting from 16 to 30 days and 12 up to 15 days.

CIO affiliated unions, including the UAW, are involved in 58 of the suppliers strikes, while AFL unions are connected with 11 and the remaining ones involve various independent unions.

General Motors passenger car production for the week ending August 10 was 21,113 representing a slight gain over the preceding week's 20,693 bringing the year's total up to 422,076. However, truck production fell off for the week as a result of two suppliers strikes which occurred at the Truck & Coach Division in Pontiac for several days. The curtailed production netted a total of only 7,464 trucks as against the previous week's total of 8,615.

Names in the News

Charles R. Cox

John S. Goble

John L. Perry, former head of Carnegie-Illinois Steel Co. has become assistant to the president of the United States Steel Corp. of Del. Mr. Perry has been succeeded by **Charles R. Cox** who has been elected president of the Carnegie-Illinois Corp. Mr. Cox was formerly president of National Tube Co., having joined that organization originally in 1934 as general superintendent of the Elwood works.

John E. Goble has been elected president of National Tube Co. He had been vice president in charge of sales since Jan. 1 and has been succeeded as such by **William F. McConnor,** general manager of sales since 1936.

W. H. Walter has been appointed chief mechanical engineer of American Bridge Co. to succeed **C. G. Baumgartner,** who has retired after 41 years with the company.

Wallace Sargis has been named general sales manager of the Jack & Heintz Precision Industries, Inc., Cleveland. In his new position he will be in charge of sales of all divisions, except products for the aviation industry.

C. H. Welch has been appointed plant manager and **J. E. Gickler** superintendent of The Alloy Cast Steel Co., Marion, Ohio.

John H. Illig has retired as plant superintendent of the Barcalo Manufacturing Co., Buffalo, N. Y. and has been succeeded by **James E. Burke,** formerly assistant superintendent.

Leo J. Pantas has been named plant manager of The Yale & Towne Mfg. Co.'s Buffalo, N. Y. plant.

Robert L. Springer, for the past seven years Chicago manager of Rustless Iron & Steel Co. and Geary Stainless Steel Co., has returned to Vanadium-Alloys Steel Co. as engineer and representative in the Chicago district.

Claude P. Parsons has been named vice president and special sales representative of the Hughes Tool Co., Houston, Texas.

Harold T. Youngren has been named director of engineering of the Ford Motor Co., Dearborn, Mich., while **Lewis D. Cruscoe** is now a member of the company's executive staff. Also, **Harold S. White** has been named to head engine research work for the company. Mr. Youngren was formerly with Borg-Warner Corp. as chief of engineering development and Mr. Cruscoe was previously assistant to **Ernest R. Breech** when he was president of the Bendix Aviation Corp.

Marcus J. Aurelius has been elected sales vice president of the United States Steel Supply Co., succeeding **Leslie B. Worthington,** who was named president on July 15.

Charles E. Willet has been named sales manager of Burton-Rodgers, Inc., Cincinnati.

A. E. Philips has resigned as vice president in charge of marketing of the International Plastic Corp., Morristown, N. J.

Ray C. Kivley has assumed his duties as superintendent of the Buffalo plant of Western Electric Co. **Max H. Specht** has been named chief of the operating division and **Morris Brown,** chief of the engineering division.

Willard M. Broxham has been named sales manager for the fabricated plate division of Graver Tank & Mfg. Co., Inc., East Chicago, Ind.

E. C. Hawkins is now in charge of the Chicago branch office of John S. Barnes Corp., Rockford, Ill.

Edward G. Baer has been named vice president and treasurer of The Will-Burt Co., Orrville, Ohio.

T. F. DeNormandie has been named branch manager of the Buffalo office of the Jessop Steel Co., Washington, Pa.

Lester A. Lanning, assistant Bristol plant manager since 1939 of New Departure, Div. General Motors Corp., has been named manager of the new division plant at Sandusky, Ohio.

Gus Gran has been appointed assistant sales manager and **Ben F. Welte** assistant chief engineer at Colonial Broach Co., Detroit.

BUSINESS ITEMS

W. R. Harrison

Cleveland Tapping Co., 3610 Superior Ave., Cleveland, has been sold to three Canton, Ohio, businessmen. New officers of the firm include: **W. R. Harrison,** former president and general manager of Spun Steel Corp., Canton, Ohio, who has been elected president; **Mark Graves,** founder of the Cleveland firm, who will serve as vice president; and **A. R. Wise,** factory manager.

Lindeteves Machine Tool Export Corp. has recently been formed with offices at 10 Rockefeller Plaza, New York City, Amsterdam, Holland and throughout the Netherlands East Indies. **N. A. Leyds,** formerly associated for 9 years with R. S. Stokvis en Zonen, is president of the firm.

Lovejoy Tool Co., Inc., Springfield, Vt., has appointed **Austin Logan Ford,** 4501 Prospect Ave., Cleveland, as its exclusive agent in Cleveland and northern Ohio area.

Charles G. Pfeffer has opened offices at 475 Fifth Ave., New York City, as a consulting gear engineer.

The Staples Tool Co., Cincinnati, has established a new sales and service office at 2970 W. Grand Blvd., Detroit. The office is under the management of **Joseph H. Miller,** former sales manager of the National Automatic Tool Co., Richmond, Ind.

Reliance Electric & Engineering Co., Cleveland, is establishing two new branch offices in Appleton, Wis., and Grand Rapids, Mich.

Reed-Prentice Corp., Worcester, Mass., has appointed **John G. Thompson** as sales and service representative in Calif. and Nev. After Oct. 10 he will be temporarily available at the offices of the Moore Machinery Co., Los Angeles.

Fonda Gage Co., Stamford, Conn, has appointed **A. C. Wickman Ltd.,** New Toronto, Ont., as its sole Canadian representative for Fonda carbide and steel gage blocks.

Patch and Talmadge, offering a complete range of consulting services on powder metallurgy, has been formed by **Earl S. Patch** and **C. Robert Talmadge** at 4 South St., Stamford, Conn.

Wallace Tube Co., a wholly owned subsidiary of **Wallace Supplies Mfg. Co.,** Chicago, has been opened for the distribution of various types of industrial tubes and fittings. The new company will carry warehouse tubing as distributors for: Bethlehem Steel Co., Pittsburgh Steel Co., Globe Steel Co., Agaloy Tubing Co., Lock Joint Tube Co., and Palmer Appliance Co.

International Detrola Corp., Cincinnati, has purchased all the steelmaking, rolling mill and fabricating plants and coal mining interests of **The Andrews Steel Co.**

Crucible Steel Co. of America's Syracuse, N. Y. branch, has moved its offices and facilities to the Larned Bldg., Room 401-5, 114 So. Warren St.

The Denison Engineering Co., Columbus, Ohio, has appointed **The Calco Machinery Co.,** 1420 Chestnut St., Philadelphia as its representative covering portions of Pa., N. J. and Md. as well as all of Del. and D. C.

Youngstown Steel Products Co. has established a New Orleans La. district office under the management of district sales manager **O. B. Ewing.**

Lukens Steel Co. and subsidiaries has opened a district sales office in the McCormick Bldg., 332 So. Michigan Ave., Chicago. **John H. Faunce, Jr.,** will be in charge of the office.

Independent Pneumatic Tool Co., Chicago, has opened a branch sales office in St. Paul, Minn., located at 220 W. Seventh St.

OBITUARIES

E. B. Gardner, vice president in charge of foreign sales for the Hanchett Manufacturing Co., Big Rapids, Mich., passed away August 14. Mr. Gardner had been with Hanchett for 18 years, having joined the firm when Hanchett purchased the Badger Machine Co., Beloit, Wis.

Carl J. Zaiser, 68, president and former general manager of Ampco Metals, Inc., Milwaukee, Wis., passed away after a two-month illness July 29.

Charles Cobb, III, 53, president and general manager of the Marshall Carwheel and Foundry Co., Marshall, Texas, died suddenly Aug. 2.

Edward B. Furry, 61, president of the Union Forging Co., Endicott, N. Y. died of a heart attack Aug. 1 He had been with the company since 1909.

Frank A. Terry, who retired in 1939 after serving as branch manager of the Columbia Tool Steel Co. for 27 years in Cincinnati, died recently.

John H. Otten, 71, former superintendent of the Bikalsky Fan Co., Buffalo, N. Y. and organizer of the Otten Sheet Metal Co., died Aug. 7 after a long illness.

Elmer C. Knapp, 55, purchasing agent for the General Railway Signal Co., Rochester, N. Y., passed away July 22.

MEETINGS

American Gear Manufacturers Association. Semi-annual meeting. Edgewater Beach Hotel, Chicago, Ill. Oct. 28-30. Newbold C. Goin, executive secretary, Empire Bldg., Pittsburgh 22, Pa.

American Machine Tool Distributors' Association. Fall meeting. The Homestead, Hot Springs, Va. Sept. 18-19. Thomas A. Fernley, Jr., executive secretary, 505 Arch St., Philadelphia 6, Pa.

American Society of Body Engineers. Technical Convention. Rackham Memorial Bldg., Detroit, Mich. Oct. 23-25. Carl W. Cenzer, chairman, 100 Farnsworth Ave., Detroit, Mich.

American Society of Mechanical Engineers. Fall meeting. Hotel Statler, Boston, Mass. Sept. 30-Oct. 3. Ernest Hartford, assistant secretary, 29 W. 39 St., New York, N. Y.

American Society of Tool Engineers. Semi-annual meeting. Hotel William Penn, Pittsburgh, Pa. Oct. 10-12. J. M. Cannon, director of public relations. 1666 Penobscot Bldg., Detroit, Mich.

Instrument Society of America. National instrument conference and exhibit. William Penn Hotel, Pittsburgh, Pa. Sept. 16-20. Richard Rimbach, executive secretary 1117 Wolfendale Ave., Pittsburgh 12, Pa.

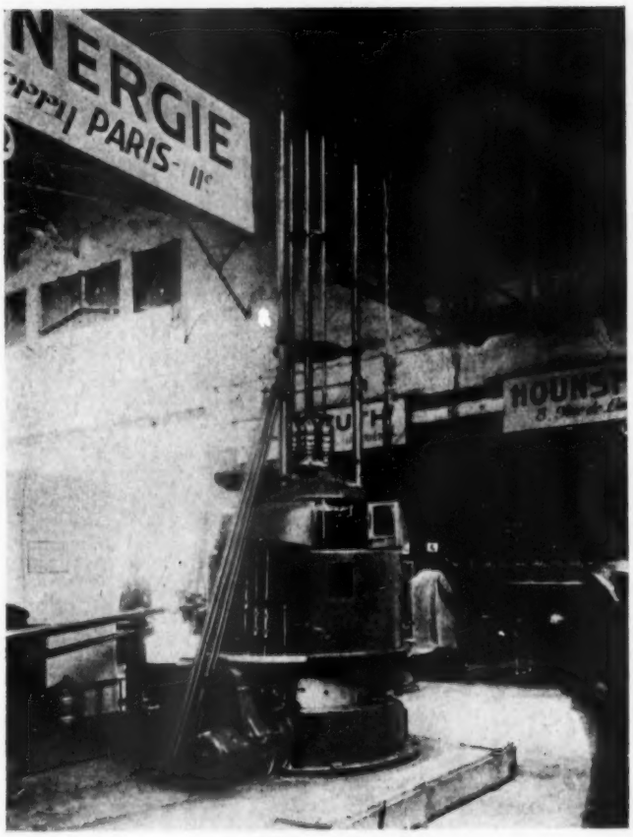
Magnesium Association, Annual meeting and exhibit. Waldorf-Astoria Hotel, New York, N. Y. Oct. 3-4. T. W. Atkins, executive secretary, 30 Rockefeller Plaza, New York, N. Y.

National Association of Foremen. Annual Convention. Kiel Auditorium, St. Louis, Mo. Sept. 12-14. Convention Headquarters, Forest Park Hotel, St. Louis, Mo.

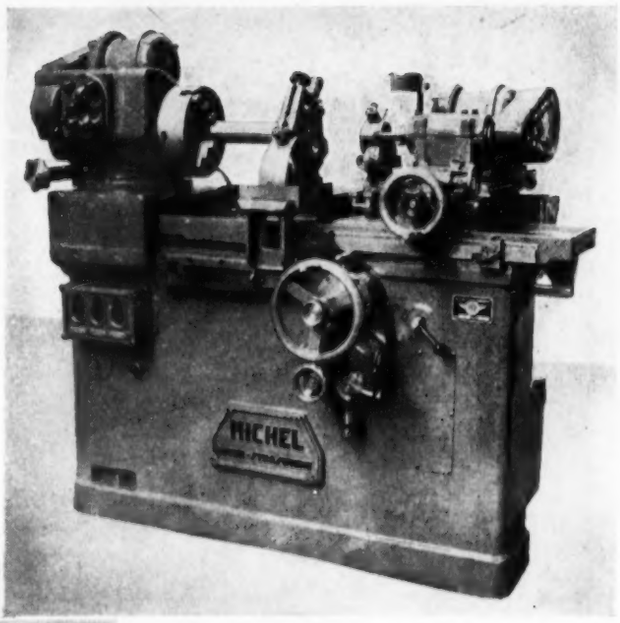
National Electronics Conference. Edgewater Beach Hotel, Chicago, Ill. Oct. 3-5. C. A. Emery, chairman publicity committee, 20 No. Wacker Dr., Chicago 6, Ill.

PARIS FAIR

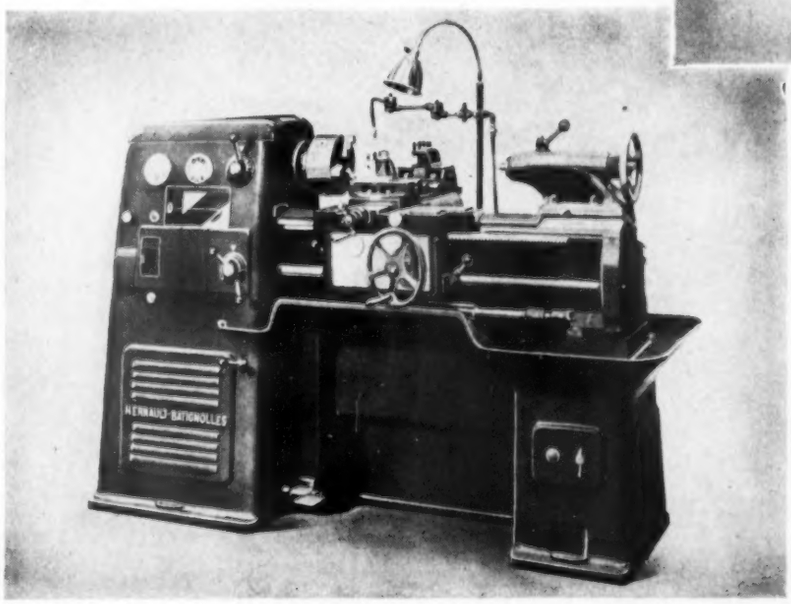
Here are some of the French, Swiss, and Italian machine tools seen at the recent Paris Fair. Some of these show marked resemblance to U. S. Machines; a few show sharp differences in their design or operation



Quantity production to precision requirements is the feature of the SSA 40 multi-spindle vertical automatic produced by the Tavannes Machines Co., Switzerland. The six stations operate simultaneously, ejecting a completed piece at each withdrawal of the tools. Hourly production ranges from 30 to 642 pieces depending on their nature.

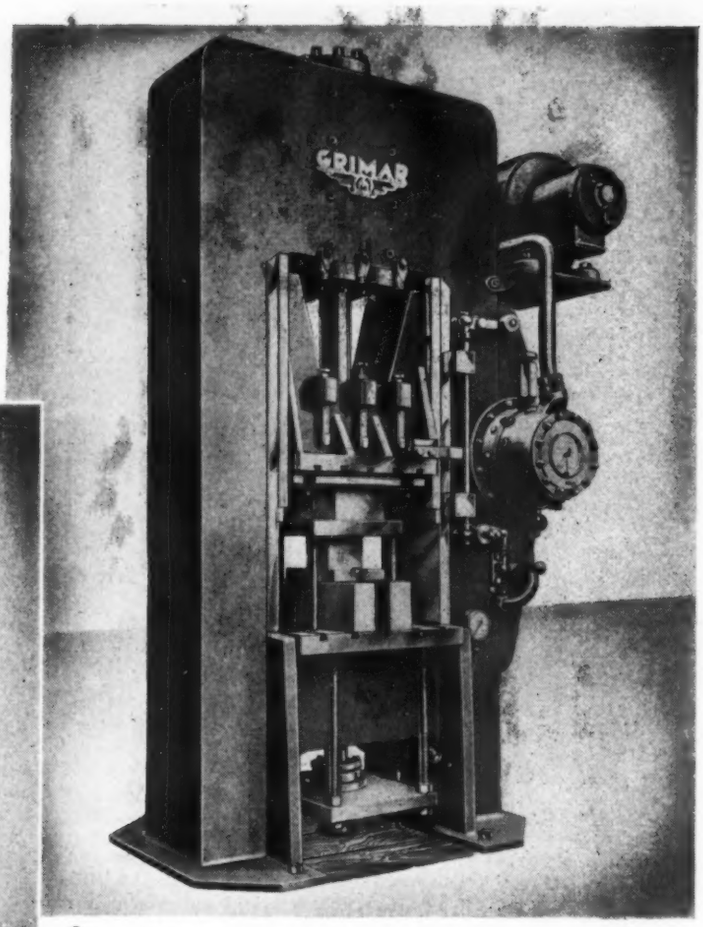


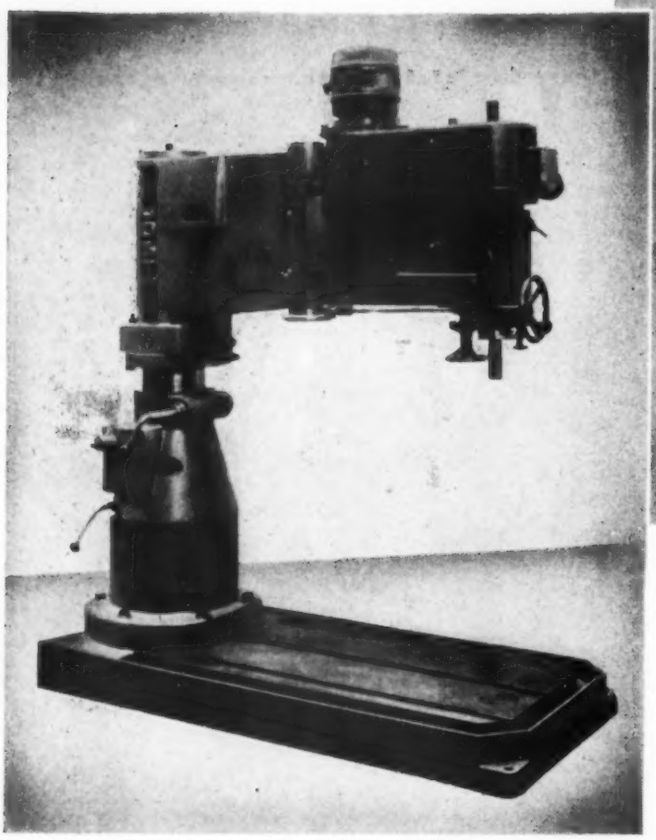
Internal grinding on work up to 500 mm. long and 425 mm. in dia. is performed on this R.M. 10 grinder made by Aviation Michel, Autun, France. Hydraulic control is included. The back rest for long work has micrometer adjustment and will handle work up to 125 mm. dia.



Controls are arranged so the operator can work seated at the type Op 320 lathe made by H. Ernault-Batignolles, Paris. The machine is designed for simple or complex work in small or large quantity. Gear box gives a range of speeds from 450 to 3,600 rpm.

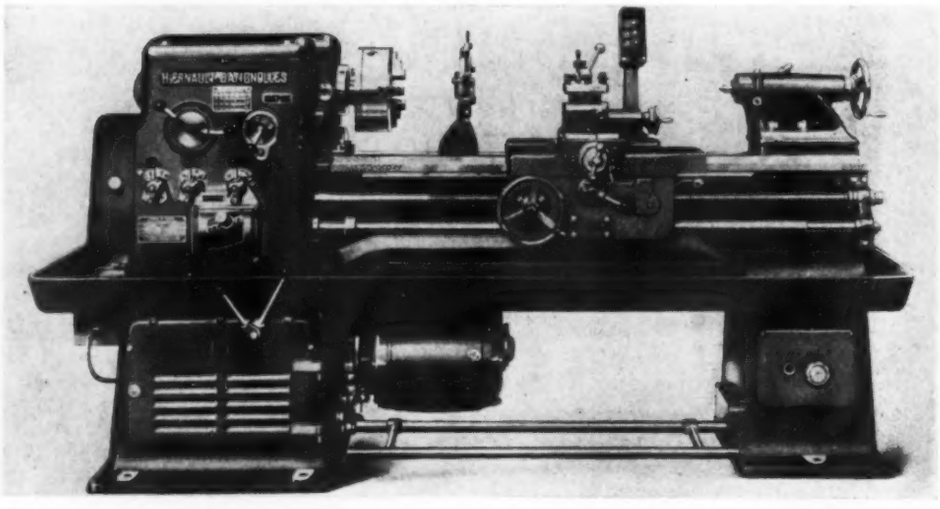
Among the large range of hydraulic presses developed by Grimar, Paris, is the one shown. The large presses have a special hydraulic arrangement for holding the blank. Included in the line are shearing guillotines for sheet-metal working which incorporate a variable cutting-angle guide, and mechanical presses for cutting and stamping which are of all-steel construction and are said to accept overloads as high as 100%.



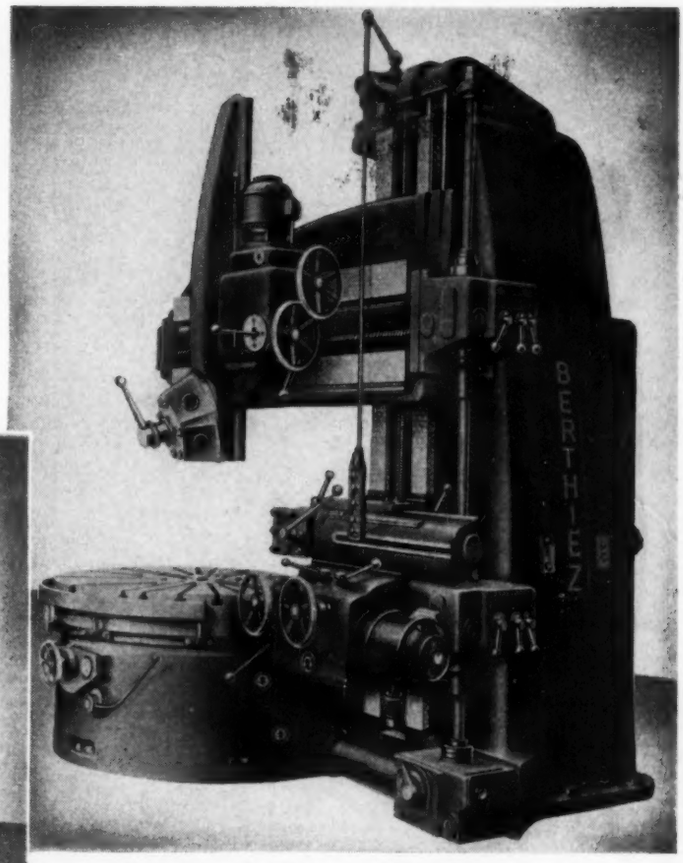


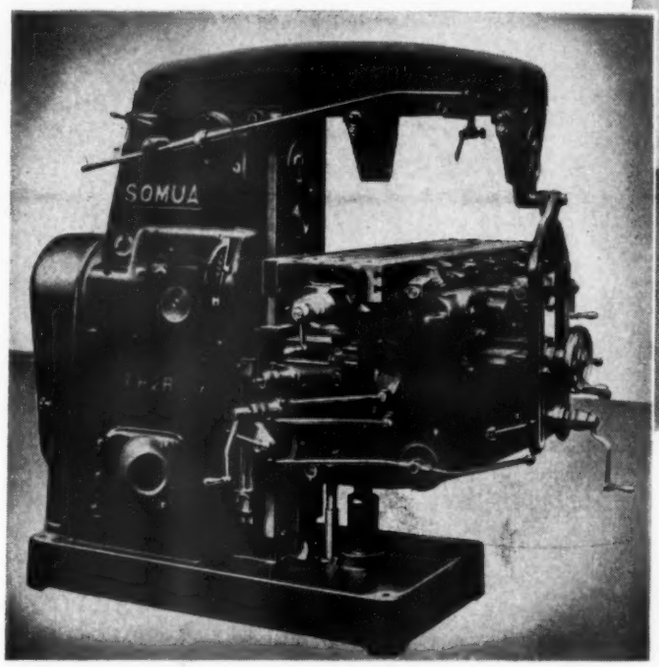
A single lever provides positive locking of the radial articulated arm in the RPS series of drills produced by Jost, Paris. Three sizes have radii of 1, 1.2, and 3.15 meters. Movement of the arm is said to be particularly light, allowing the drill to center itself when brought down on the punched position on the work. The spindle has infinitely variable speeds from 75 to 1,500 rpm., with feeds from 0.05 to 0.2 meters per min. The largest size is intended for use in shipbuilding yards.

Screwcutting lathes in the HN series made by H. Ernault-Batignolles, Paris, are designed to permit use of carbide tools. Two types have center heights of 170 and 200 mm. Braking is effected by an electro-magnetic device controlled by a foot bar located between the pedestals. The lathes have 16 speeds with ranges from 50 to 2,000 rpm. and 32 to 1,600 rpm. in the two models with a 10-hp. motor. The leadscrew can produce 28 metric and 28 English threads from 28 to 2 threads per in., through the standard gearbox. Lubrication is automatic.

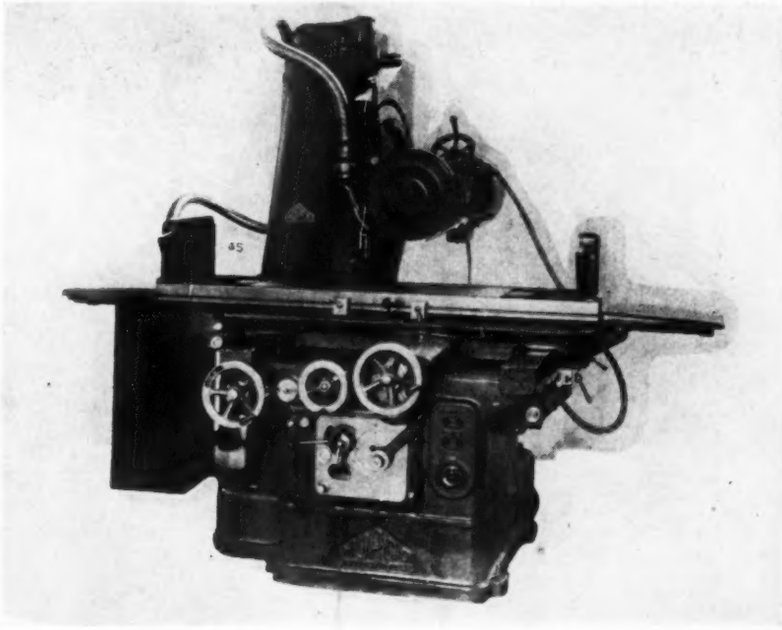


A vertical boring mill with hexagonal turret mounted on the arm and square-turret tool carrier on the column, both of which can be inclined from their respective planes, was shown by Charles Berthiez, Paris. The turret on the arm is adjustable 38° either side of the vertical, and the carrier on the column 30° either side of the horizontal. The table has 12 speeds from 3 to 150 rpm. and each tool position has 16 feeds from 0.2 to 6 mm. per rev. The table is 1 meter in diameter.

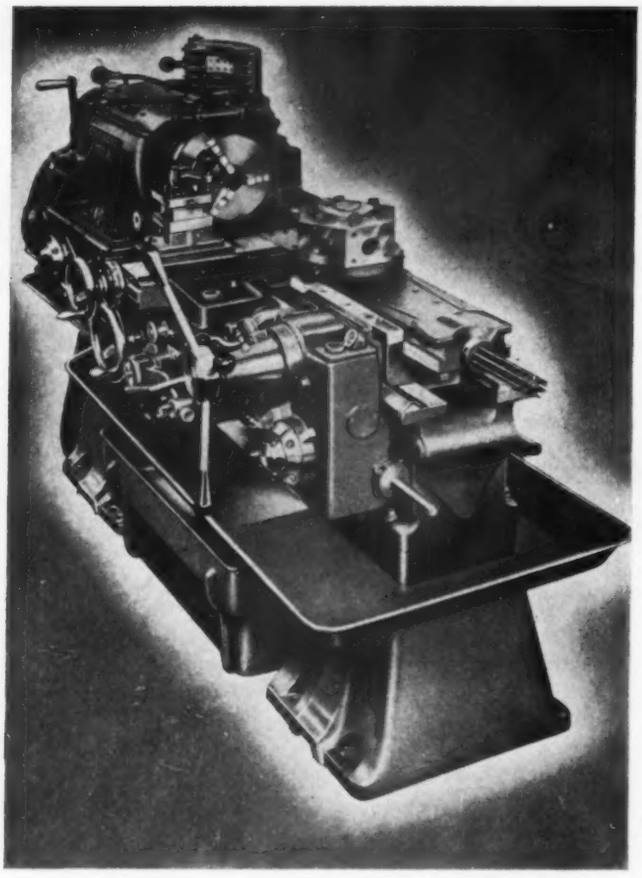




← **The universal milling machine,** type FH2B, is one of a wide range made by Somua, Saint-Ouen-Sur-Seine, France. A series of dead stops allows automatic control of a predetermined cycle. Hand controls are duplicated at the rear of the machine. Speeds range from 16 to 1,600 rpm. in two 16-speed ranges.

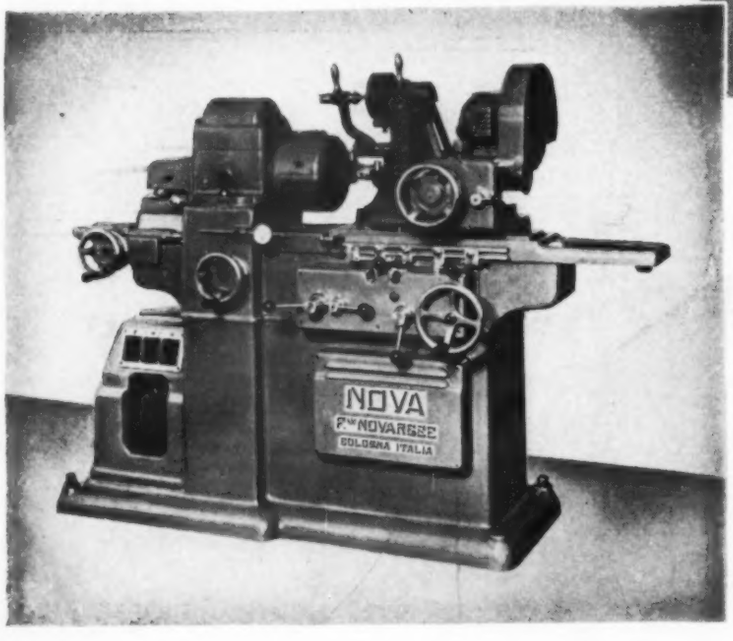


→ **The spindle is adjustable** around the column to permit grinding at any angle up to 90° from the horizontal in the surface grinder made by Mopco, Saint-Quentin, France. The wheel motor is mounted directly on the wheelhead, in such a way that the entire assembly can swing in an arc. Hydraulic control is included with the table speed infinitely variable from 3 to 25 meters per min. Transverse movement of the table up to 340 mm. is controlled by a handwheel with vernier graduated in 0.01 mm.



← **The universal turret lathe,** Maxnovo RU-4, is of Italian make, as are the other machines on this page. Made by G. G. Bosseti S.A., Novarra, Italy, it has a maximum swing over the cross slide of 10 in. The turret has 32 feeds from 0.012 to 1.20 mm. per rev. A range of 12 spindle speeds may be either 39 to 760 rpm. or 48 to 900 rpm. as needed. The speed indicator is an illuminated dial mounted on the headstock. Both longitudinal and transverse feeds are controlled by a single lever with reversal selected by a second lever. A locating pin assures exact indexing of the turret. On the return stroke, the turret unclamps automatically, indexes to the next station, and clamps.

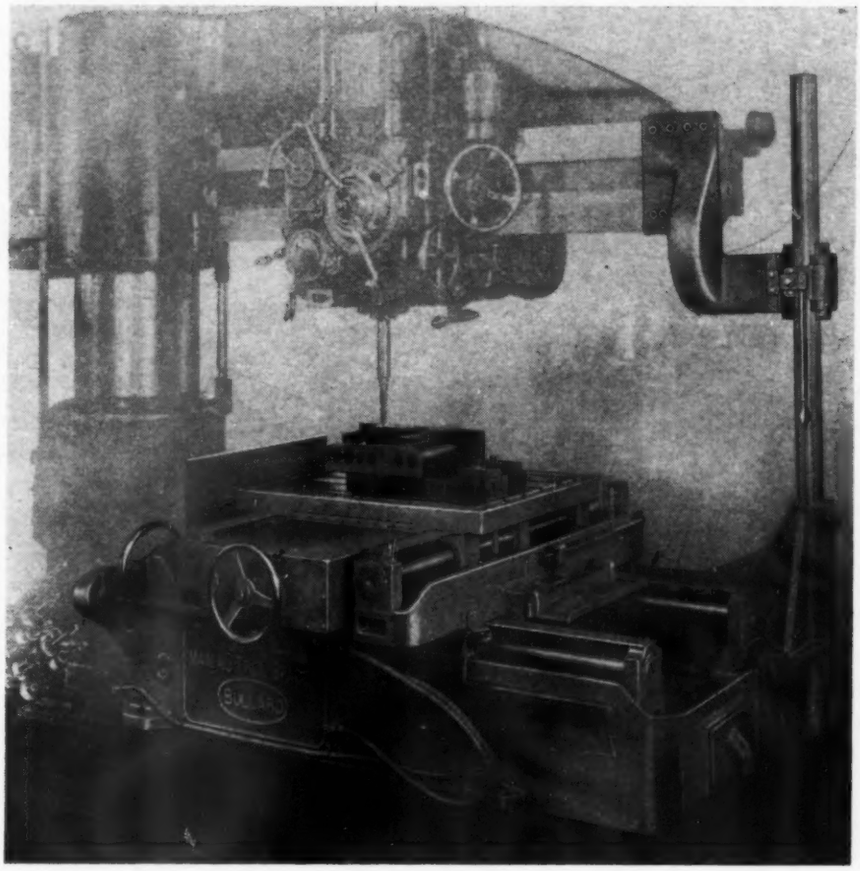
→ **The small precision grinder** Zocca R. A. 210 has gearing isolated from the machine to eliminate motor vibration. It was designed originally for grinding parts for injectors and injection pumps for diesel engines. It can be used for taper and parallel grinding.



← **This internal grinder** is made by F. Novarese, Bologna, Italy. It has a capacity of 6 to 100 mm. internal dia. The wheel motor is 1¼ hp., carried on the wheelhead. The table has a maximum stroke of 320 mm. A diamond carrier is provided with both longitudinal and transverse adjustment, with micrometer scale. A special arrangement permits the grinding of internal shoulders to high limits of accuracy. Control of the wheel is by a handwheel located on the front, with micrometer adjustment.

Shop Equipment News

Bullard Man-Au-Trol Spacer Locates Work for Drilling Without Jig Use



Holes are drilled by a fixed spindle using the Man-Au-Trol Spacer. Work is positioned hydraulically by the table which moves to pre-determined positions to duplicate any desired drill pattern

Pin-point precision in the drilling of holes without the use of jigs is reported possible through a device developed by The Bullard Co., Bridgeport 2, Conn. Called the Man-Au-Trol Spacer, it is said to result in a time-saving of 20% or better.

Potential impact of the unit is indicated by a statement from the Bullard plant that drill jigs and special tools costing about $500,000 to make will not become scrap at that plant.

The spacer consists of a heavy, flat table, which moves laterally or longitudinally under an accurate drill spindle fixed rigidly in one position. With the work clamped in place, the table is hydraulically traversed from one pre-determined position to another by two selector controls.

Setting the selector dial determines which one of a number of pistons receives the hydraulic pressure. Motion continues until the piston in the cylinder reaches a positive stop, position of which is selected through screw adjustment. Once the stops are set, the table will return to them with extreme accuracy.

There is one hydraulic cylinder for each longitudinal and transverse motion. Thus if ten cylinders were provided for each direction, 100 positions would be available. Force from a balanced master cylinder, working in conjunction with any active cylinder, provides rapid, smooth motion from one location to another and locks the table against the stop.

Hydraulic power to operate the spacer is provided by a self-contained pump operated by a constant-speed motor. This is the only electrical equipment required. The spacer may be applied to various types of drilling machines and will be made in a variety of sizes.

In a demonstration of the Man-Au-Trol Spacer, a pattern of four holes was drilled in a ⅝-in. thick square of steel. The pattern was then repeated in another piece of steel of the same size. One plate was then placed on the other and four steel pins, finished to a diameter about 0.0005 less than the holes, were inserted.

The holes in both pieces are reported to have matched perfectly, with the pins creating a slight vacuum that caused a "pop" when they were withdrawn. Every possible combination of holes was tested in the same manner. The sliding fit in each case testified to the accurate location of the holes and to the fact that each was drilled in a plane precisely perpendicular to the surface of the steel.

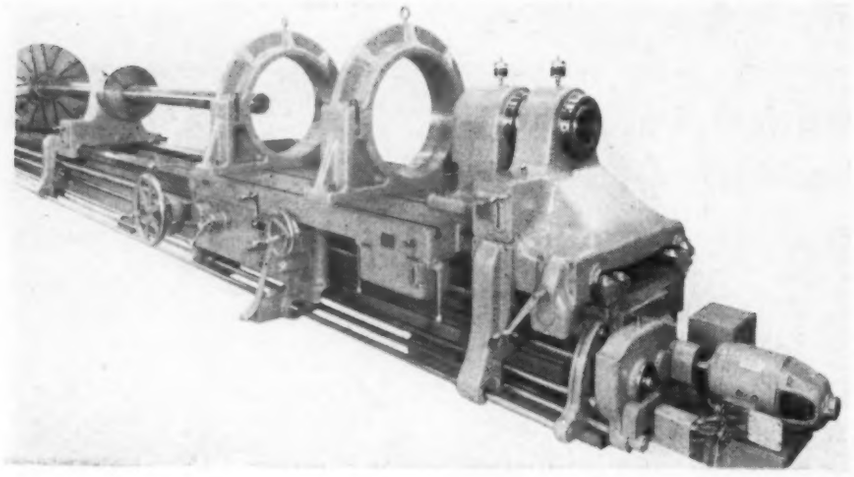
Economies that will result are said to be indicated by experience in the Bullard plant. One lot of 74 pieces customarily required more than 70 hours for drilling using a jig. The spacer saved more than 10 hours in time and eliminated the jig which had cost nearly $350.

It is customary with a radial drill to change tools to complete all work on a hole while the spindle is in place. Because of the precision with which the spacer operates, the operator can use one drill until all its work is done before changing to a tap or other tool that may be required.

Operator fatigue is at a minimum with the new unit and inspection is simplified. Once a piece is spotted and location of the holes checked, the spacer is said to reproduce the pattern with unfailing accuracy.

Sizes of the device will vary from one with a table a few inches square to those handling massive work.

American Tool Co. Boring Lathe Leaves Bar Mounted When Unloading



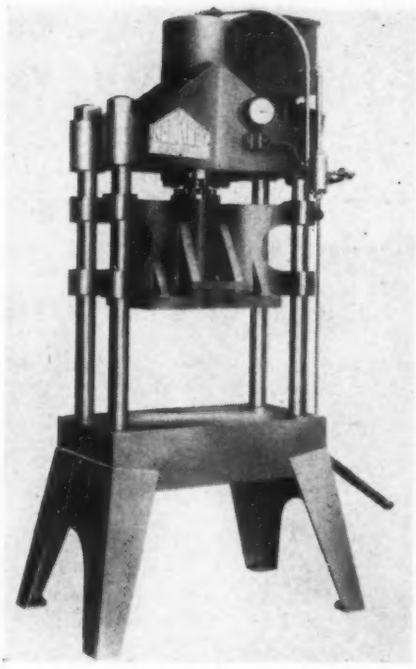
The lathe carriage in the loading and unloading position. Work can be removed without having to remove the 2400-lb. boring bar

Equipment designed for finish-boring cylinder liners up to 28-in. in dia. for diesel engines has been built by the American Tool Co., Cincinnati 2, Ohio.

The lathe is a 48-in. "Super-Productive" model with a 34-ft. one-piece bed. It is driven by a 30-hp., 3 to 1, adjustable-speed dc. motor with electrical speed control at the operator's position at the apron.

The carriage is made in the form of a large platen on which are mounted two work-holding rests and a boring-bar support. It is accurately fitted to the four V's of the bed and alignment is maintained by taper gibs under each of the four bed V's. Bed-mounted independent front and rear boring-bar supports are provided to further support the bar.

The boring bar is 7 in. in dia. 19-ft. long, and ground its entire length. One end is held in a driver attached to the face plate and supported by the three rests. The bar is supported by bronze bushings which revolve in nitralloy bearings. Lever-operated plunger pumps force large quantities of oil to all bearing surfaces. Boring bar bearings are lubricated by means of sight-feed oilers. An important advantage of this method is that the 2400-lb. boring bar remains mounted in the lathe at all times. It does not have to be removed and remounted when unloading work.



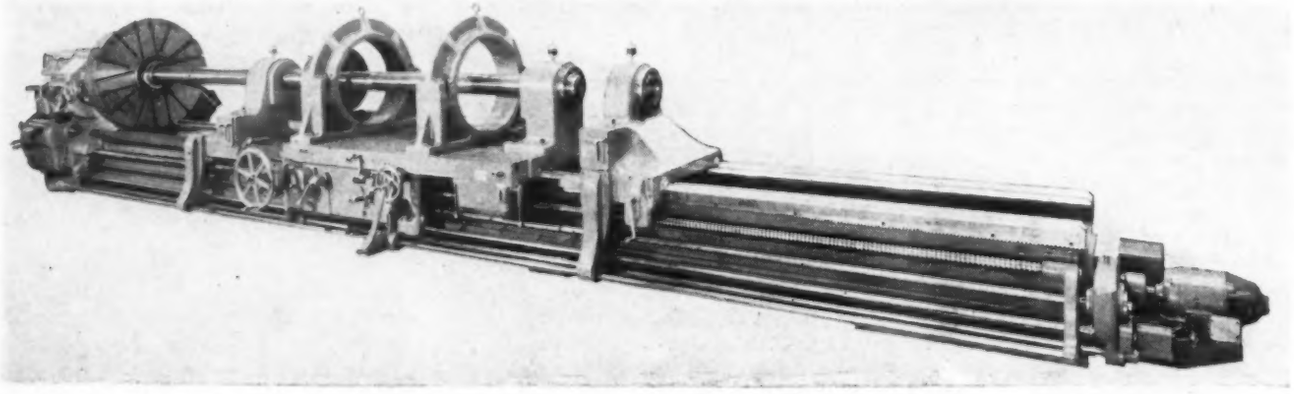
Keckley Die Try-Out Press Has Double-Acting Cylinders

A hydraulic die try-out press is announced by O. C. Keckley Co., 400 W. Madison St., Chicago 6, Ill. The press has a double-acting cylinder.

The operator is said to be able to feel the punch entering the die. Pressure is available on the upstroke to spread the die.

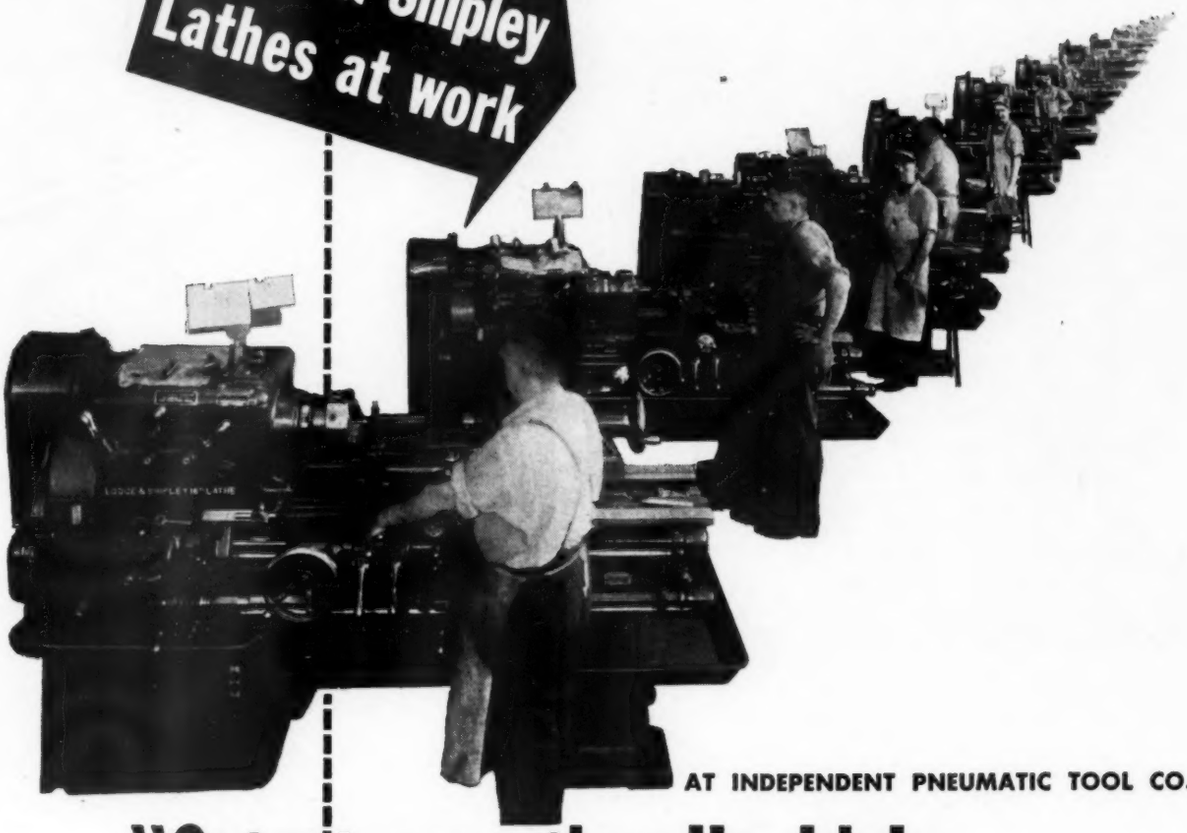
The Keckley Prefill system allows the operator to bring the punch down to the die by merely shifting a valve. When the pump meets resistance, it stops, and the cylinder being already prefilled with oil, a few strokes of the pump handle will apply pressure.

Maximum capacity is 75 tons with a 15-in. ram stroke. Distance between the platens is 18 in.



This lathe with a 34-ft., one-piece bed is designed for finish-boring cylinder liners up to 28 in. in dia. It is designed for use with cemented-carbide cutters in the boring head and is driven by a 30-hp. motor

Lodge & Shipley Lathes at work



AT INDEPENDENT PNEUMATIC TOOL CO.

"Output exceptionally high . . . in hundreds of experimental jobs!"

"Something special" is an understatement of the experimental work done at the Independent Pneumatic Tool Co., Aurora, Illinois. Everything is special—hundreds of varieties of parts for Thor portable power hand tools—universal and hi-frequency electric and pneumatic types.

In the illustration, Independent's battery of 16" Lodge & Shipley Lathes is producing cylinder bushings, motor housings, throttle valves and air regulator parts. Practically every type of cutting tool is used in working all ferrous and non-ferrous metals. In "every conceivable machining operation", Independent states, "production is exceptionally high . . . beyond expectation." Time savings up to 20 per cent are reported.

Lodge & Shipley Lathes, as this user reports, "are high quality tools, meriting the consideration of anyone intending to purchase this type of equipment."

Call in L & S Engineers for expert advice on any lathe problem. They will be glad to demonstrate the many advantages of L & S Lathes on your work. Write on company letterhead for condensed catalog showing complete line.

ENGINE
TOOL ROOM
MANUFACTURING
OIL COUNTRY
DUOMATIC (AUTOMATIC) LATHES

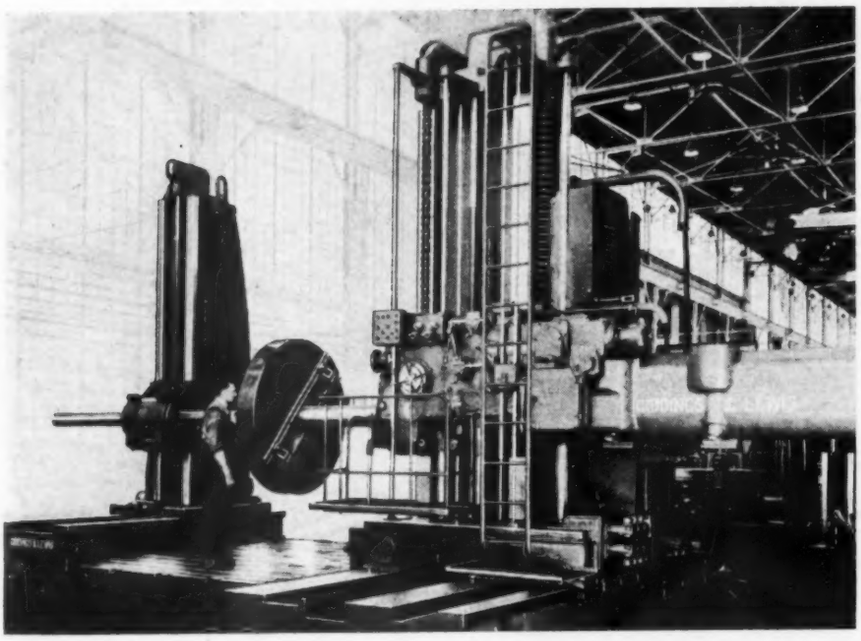
THE LODGE & SHIPLEY MACHINE TOOL CO.

L & S LATHES

CINCINNATI 25, OHIO, U. S. A.

MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

Giddings and Lewis Boring Head Handles Variety of Operations



In this installation the continuous feed facing head is mounted on the boring bar of a floor-type horizontal boring machine

A continuous feed facing and boring head manufactured by Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., makes possible a variety of boring, turning, grooving, recessing, and threading operations which are difficult to handle on ordinary equipment.

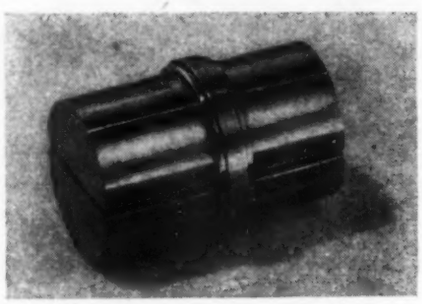
The attachment may be mounted either on the spindle sleeve of the horizontal boring-machine headstock or, with an adaptor, on a line boring bar. When placed on the headstock, the machine spindle extends through the attachment head and operates either independently or simultaneously with the head. This combination will reduce overall production time.

When used with an adapter and mounted on the line boring bar, it is easier to machine hard-to-reach surfaces.

Continuous feed facing heads are available in sizes ranging from 17- to 60-in. diameter. Cross travel of the toolslide ranges from 10 in. on a 22-in. dia. head to 34 in. on a 60-in. head. The maximum facing diameter is 32 in. using a 22-in. continuous feed facing head and 96 in. when a 60-in. facing and boring head is used.

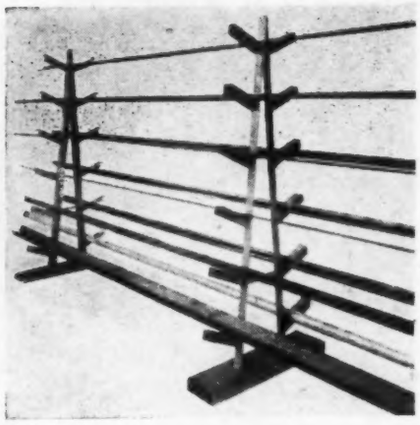
Six power feeds arranged in geometrical progression are available through a manual selector. The toolslide will feed in either direction. A micrometer dial registers the amount of feed in increments of 0.001 in. A complete turn of the dial moves the tool slide ¼ in.

Asco "Auto-Arb" Expanding Arbor Works Without Stopping Spindle



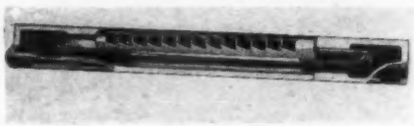
An expanding arbor, the "Auto-Arb," for use on secondary operations where the work piece is held by the inside diameter, is announced by the Asco Corp., 874 East 140th St., Cleveland, Ohio.

The arbor permits chucking and unchucking without stopping the spindle when used on a screw machine or lathe with standard collet. It expands accurately and maintains concentricity with the collet. It is made in sizes from ⅜ to 1 in. with intervals of 1/64 in.



STEEL RACKS—Welded-steel racks for handling bar stock and similar items are made by Massey Machine Co., 800 Pearl St., Watertown, N. Y. Racks are made double as shown or in single style for stacking next to a wall

Glenny Keyway Push Broaches Made Available in New Sizes



Addtions to the Glenny adjustable-expansion keyway push broach line, have been announced by the East Shore Machine Products Co., East 140th St. and Aspinwall Ave., Cleveland, Ohio. American Standard Keyway sizes have been included.

Broaches in steps of 1/16-in. dia. have been made available for use when standard sizes are not desirable. The broaches may be used on an arbor press, lathe, turret of a screw machine, or other standard equipment.

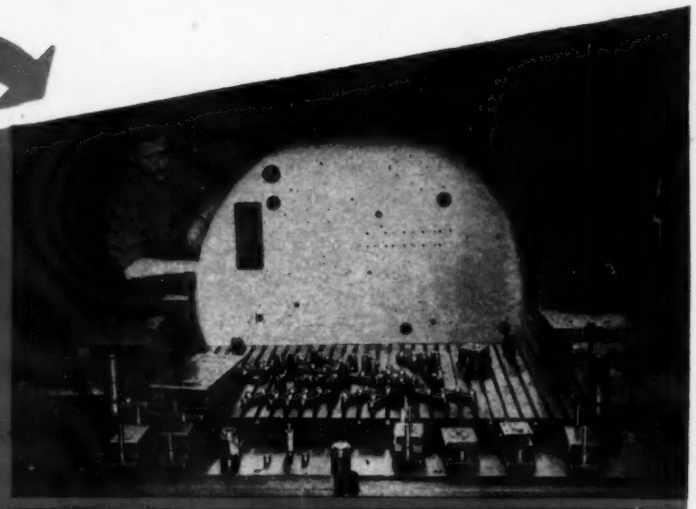
Detrex Compact Degreasing Unit Cleans Small Screw Machine Parts

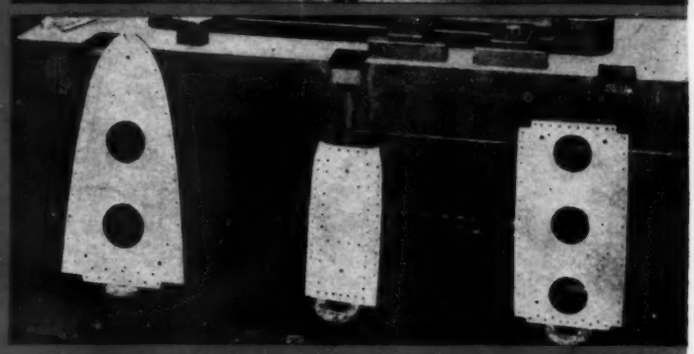
A conveyorized one-dip concentrator of compact design, the 1 DC-750, for degreasing small screw machine parts is announced by Detrex Corp., 14331 Woodrow Wilson, Detroit 32, Mich.

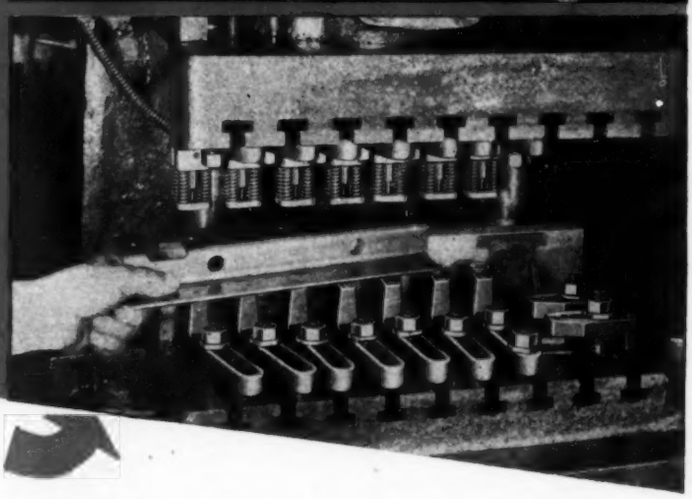
The machine occupies less than 75 sq. ft. of floor space and measures 9 ft. 9 in. in height. Rotary baskets 10 in. in diameter and 20-in. long are used to carry the work, or a combination of rotary and flat baskets can be used. The work is returned through the upper hood and unloaded at the same end of the machine as it is loaded.

Some examples of what can be done with Whistler Adjustable Dies. Work in practically any type press.

Re-use same WHISTLER ADJUSTABLE DIES in unlimited combinations







1 To Pierce Holes of any diameter from 1/32" up.

2 To Perforate Special Shapes.

3 To Notch Corners.

Save production time and reduce product costs by having Whistler punch and die units in your tool room.

Whistler notching dies, group dies and standard units are especially adaptable to combined use in the same set-up. Continued re-use in a variety of arrangements quickly writes off original investment. Reason enough for their expanding popularity with hundreds of America's best known manufacturers.

Now available from stock in a range of diameters up to 3", shipment can be made the same day your order is received. Special sizes, shapes, notching and group dies are made to order in a few days.

You get production economy plus precision perforating in practically any press with these Whistler dies. Set-ups are easy and fast. No special tools required. Heavy duty series easily pierces 1/4" steel. All parts interchangeable. Tolerances maintained to .0002". There are many other advantages. Get in touch with Whistler.

WRITE FOR YOUR WHISTLER CATALOGS. Know the production advantages of Whistler Adjustable Dies.

S. B. WHISTLER & SONS, INC.

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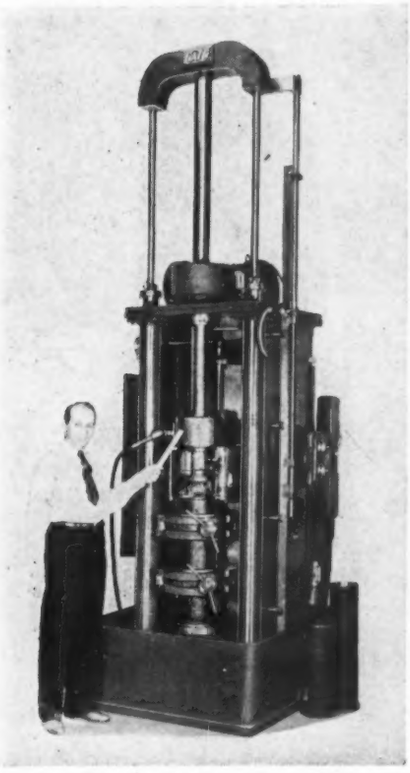
Giern & Anholtt Vertical Borer Takes Cylinders 40-in. Long



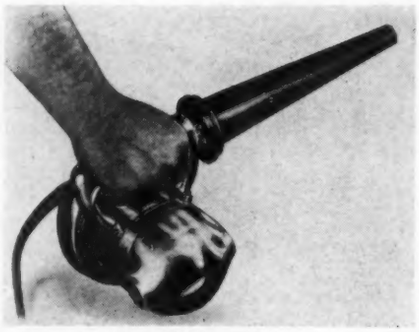
A vertical boring machine for precision rough and finish boring large cylinders up to 40-in. in length and 6 to 8 in. in dia. is announced by Giern & Anholtt Tool Co., 1301 Mt. Elliott Ave., Detroit 7, Mich.

The machine, Model TR, has the spindle piloted directly above the work in a Gatco sealed rotary bushing. It is equipped to bore cast iron, steel, or non-ferrous tubes, using multiple-blade boring cutters.

The machine is hydraulically operated with a feed for 8-in. inside diameter tubing of 4 ipm. in roughing and 4½ to 5 ipm. in finishing. Coolant provisions are incorporated with the direct flow of coolant over the cutter for the entire depth of the cut. Power requirements for the operation mentioned are about 10 hp.

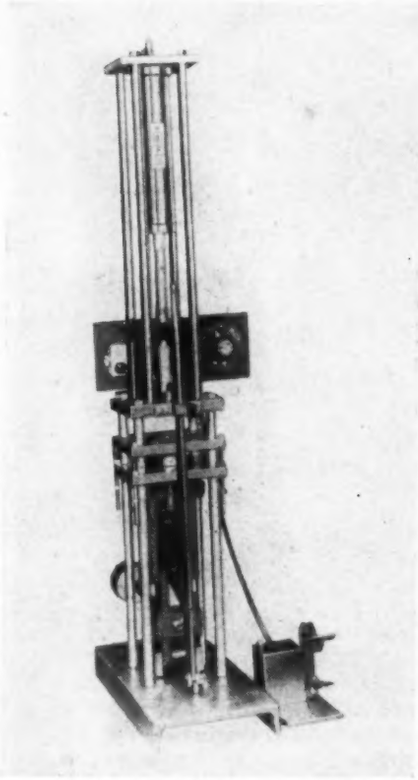
Breuer Electric Hand Blower Has A Balanced Fan Design

A small hand blower of improved design, Model 46, is announced by Breuer Electric Mfg. Co., 5084 N. Ravenswood Ave., Chicago 40, Ill. The new unit is said to have a balanced fan design which provides greater air displacement and adds strength and durability.



Screened openings around the side of the motor housing concentrate air over the commutator and brushes for cooling. The switch is installed at the end of the handle. The unit is equipped with a 1/3-hp. universal motor with sealed ball bearing.

Munton Injection-Molding Press Is Operated by Pedal Action

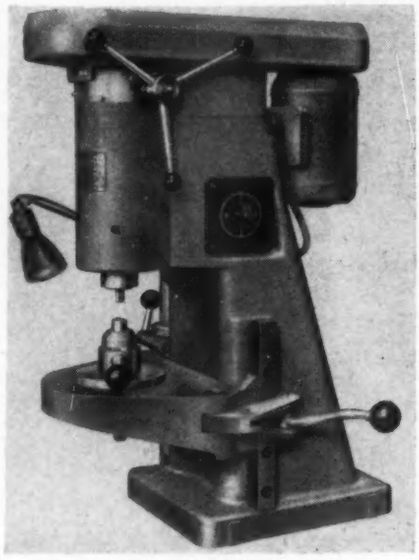


A hydraulic press for thermo-plastic injection molding in small runs or for experimental purposes is announced by Munton Mfg. Co., Franklin Park, Ill.

Comparatively inexpensive die-molds can be made for the press in developing new products. The press, which is of vertical construction, occupies only 24 x 48-in. floor space. It has a mold space 9 x 9 x 5 in. and will handle up to 3 oz. of plastic.

Pressure is obtained through a hydraulic ram operated by a pedal. Temperature is controlled in the heating chamber with a thermostat equipped with a light which goes out when the desired set temperature has been reached, and lights when the temperature drops. To release the piston, the operator steps on the lower treadle and the piston returns to neutral position.

Square and Other Polygonal Holes Can Be Drilled With SMM Machine



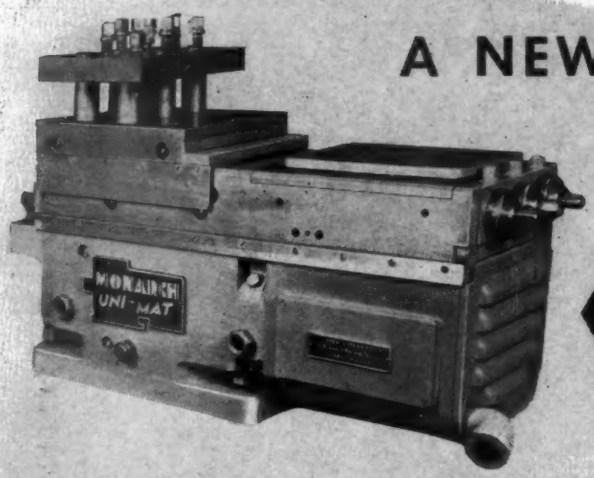
Polygonal holes are drilled with the SMM drilling machine made in Switzerland and distributed by Gubelin International Corp., 336 Park Ave., New York 22, N. Y.

A gear makes the drill rotate about its own axis and gives it at the same time a circling motion about a central axis. The machine can be built for drilling holes with any desired number of sides. Since no templates are used, there is said to be practically no wear of the constructional parts.

The drilling depth amounts to twice the width across the flat for square holes up to 14 mm. and hexagonal holes up to 13 mm. across the flat. Larger holes can be drilled to a depth of 30 mm. Drilling time is two to four times as long as for a circular hole of the same size.

Width across the flat can be varied from 4 to 24 mm. A drill is required for each type and size of multi-sided holes. The machine can be adjusted progressively for holes of various shapes according to a table mounted on the spindle. The machine has six spindle speeds from 160 to 830 rpm.

A NEW PRINCIPLE IN METAL TURNING—



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(INDEPENDENT MOTOR-DRIVEN TOOL SLIDE)

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THE UNI-MATIC
(A UNIVERSAL AUTOMATIC TURNING MACHINE)

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Name_____ Title_____

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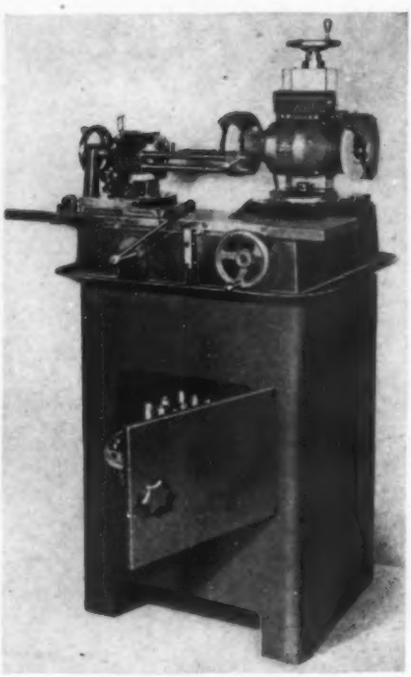
D-S Tool Grinder Produces Radial and Helical Relief

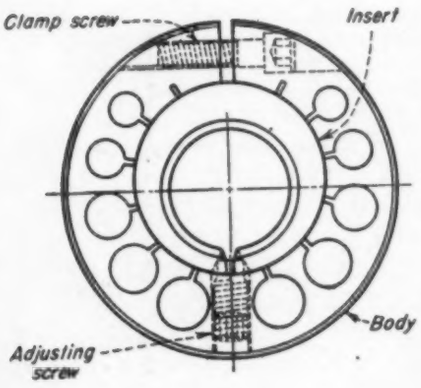


A tool grinding machine, the D-S, is announced by the D-S Grinder Div., Royal Oak Tool and Machine Co., Royal Oak, Mich. It is said to make radial relief grinding easier than regular angular back-off relief grinding.

Radial and helical relief can be produced simultaneously. Any desired margin may be left on the side blades.

Cam and index plates provide for grinding any tool of one to 12 flutes with identical relief on each blade.

Woodworth Thread Ring Gage Stays Round When Adjusted



An adjustable thread ring gage of new design has been developed by N. A. Woodworth Co., 1300 E. Nine Mile Road, Detroit 20, Mich. Tests are said to have proven that the gage is round within 0.0002 in. after 0.005-in. adjustment.

Adjustment in size is made along the thread helix angle so that no offset of the threads is produced when they are adjusted. The shape of the insert and body is such that the gage closes in a round form when adjusting rather than the triangular form which results when rings of uniform depth are used.

A green outer body is used for the go gage and a red body for the not-go gage to provide positive identification.

Gage for Setting Planer Tools Can Be Used as Lathe Stop

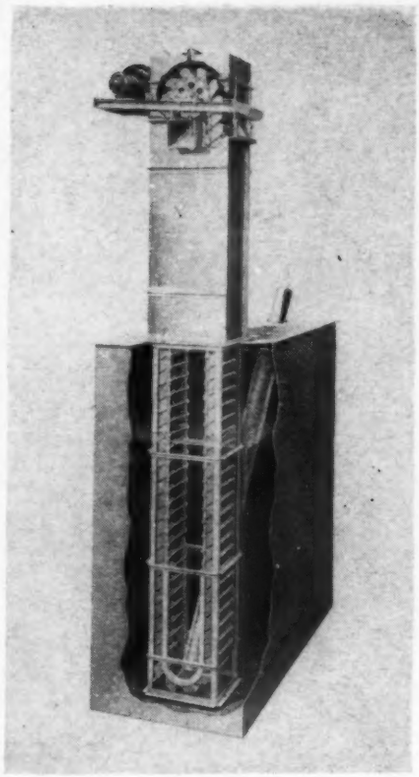
A Micro-Planer Gage developed by Accurate Machine Products Co., 1640 S. Hobart Blvd., Los Angeles 6, Calif., provides a means for setting measurements accurately in thousandths of an inch. It is designed for setting cutting tools on planers and shapers, and may be used as a carriage stop for lathes or drill press stop wherever accurate control is needed.

The body rotates on ground micrometer 40-pitch threads, raising in increments of 1/1000th. A lock in the base prevents the tool from getting out of adjustment after setting. The range is ½ in. without extrusions and up to 2 in. with extrusions.

Link-Belt Bucket Elevator Handles Delicate Parts

An internally loaded, loop-type bucket elevator, the "Interno," which is suited to gently handling delicate, manufactured parts is announced by Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill.

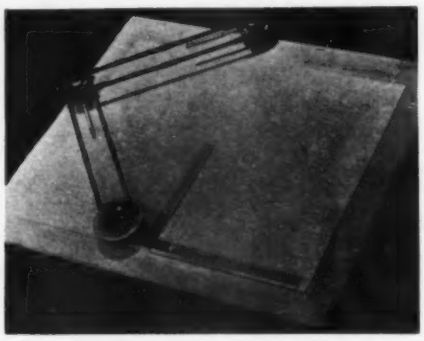
An endless series of overlapping, inwardly-opening continuous buckets supported by a steel roller chain operates over sprocket wheels at the top of the lift. Buckets are internally loaded at the foot from a chute extending through the casing.



The elevator can be loaded on both sides and can be discharged at the top to either side, through a rubber-lined chute or to a conveyor extending under the bucket line.

In the version illustrated, the elevator is arranged for quenching small parts after heat-treatment. The elevator buckets are perforated to permit draining oil back into the tank.

Boardmaster Drafting Machine — Has All Controls Near Left Hand



A new model drafting machine, the Boardmaster, is announced by Universal Drafting Machine Co., Cleveland 14, Ohio.

All operating controls are grouped

Gear Finishing

Gear Cutting

THE GEAR CUTTING TWINS

Ever since the introduction of crossed-axis gear finishing, there has been a crying need for a gear cutting machine which could keep pace—gear for gear—with the output of gear finishers like the Michigan 900.*

This need has now been filled with the introduction of the new line of Michigan SHEAR-SPEED gear shapers which will cut gears as accurately as they can be cut by *any* high production gear cutting machine and cut them *as fast as you can finish them.*

One SHEAR-SPEED and one Michigan Gear Finisher thus represent a gear-cutting "UNIT". You can now plan your gear production in "Units" per hour or per day.

In addition, you save countless machine hours, and produce better gears at lower cost.

#1800-45—describing the new SHEAR-SPEED machine
#900-44—covering the Michigan 900 Gear Finisher*

*Rotary gear finishers also available. For recommendation of type best suited to your needs specify your gear production requirements.

ORIGINATORS of GEAR-SHAVING

MICHIGAN TOOL COMPANY

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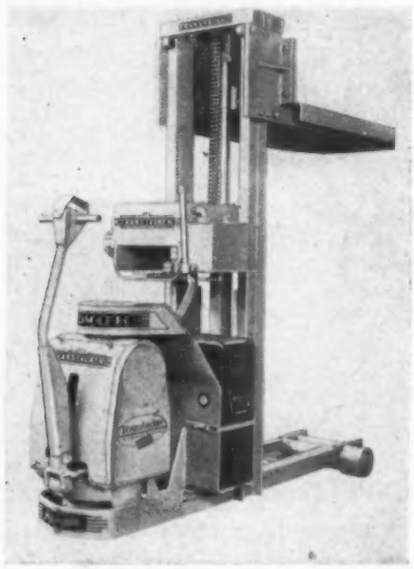
in a small area for operation by the left hand. The protractor design permits full visibility of the dial throughout 360°.

The basic unit can be used on horizontal, sloping, or vertical boards. Accessory units which are available are used. The basic unit has a range from 0° to 3°. Adding a cartridge stabilizer to the upper arm increases the range to 7°, adding an additional stabilizer to the lower arm increases it to 20°, and with a weight counterposing unit the board may be used vertically.

Transtacker Is A High-Lift Battery-Powered Tiering Unit

A battery-powered high-lift · tiering unit, the Transtacker, which does the work of a fork-lift or high-lift platform truck where weight, size, speed, or cost makes the larger unit im-

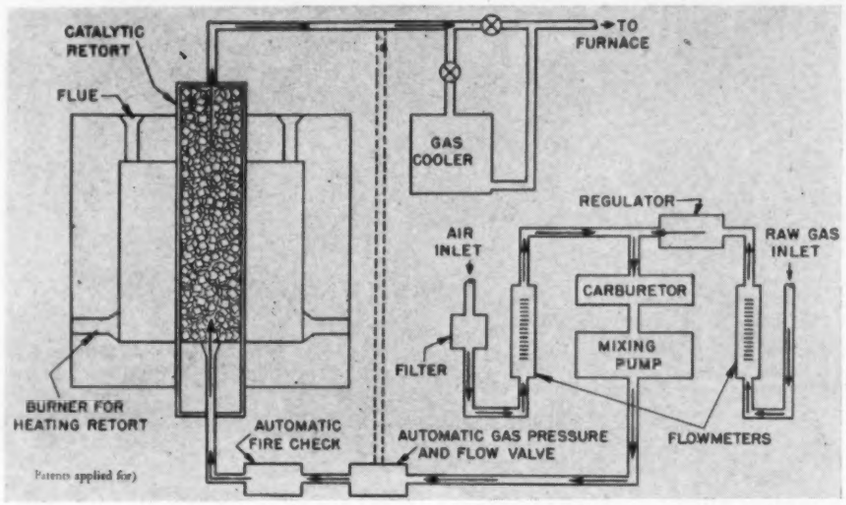


practical, is announced by Automatic Transportation Co., 149 W. 87th St., Chicago 20, Ill.

Four models are available to handle all types of pallets and skid platforms. Overall height of the unit is 83 in., to clear standard 7-ft. doors. Two buttons on the guide handle control forward and reverse power, with a third button operating the lift of the platform.

The platform model for skid loads has a capacity of 4,000 lb., and the open-face pallet model, a capacity of 3,000. The straddle-type pallet model, for single- or double-face pallets, has a capacity of 4,000 lb. The extended load or "cantilever" pallet model for double- or single-face pallets, has a capacity of 2,500 lb.

Lindberg Generator Provides Atmosphere for Several Furnaces



Schematic flow diagram for the HYEN Hydryzing generator which produces a clean, dry gas for hardening, brazing, and sintering

A new development in endothermic atmosphere generators is the HYEN Hydryzing generator, built by Lindberg Engineering Co., 2444 W. Hubbard St., Chicago 12, Ill. It is a fully-automatic central station unit that can furnish atmosphere for a number of furnaces.

The generator produces a clean, dry gas for hardening, brazing, and sintering all medium and high carbor steels without decarburization or carburization.

After lighting the pilot, all phases of operation are controlled by means of pushbuttons. Generator requires no charcoal, and does not have to be burned out periodically to remove soot. The unit operates by city gas, natural, propane, or butane for both atmosphere and heating. It is built in four standard sizes, 500, 750, 1500, and 2500 cfh.

Enesay Drill Cuts Hard Steel; Tensile Strength 45,000 psi.

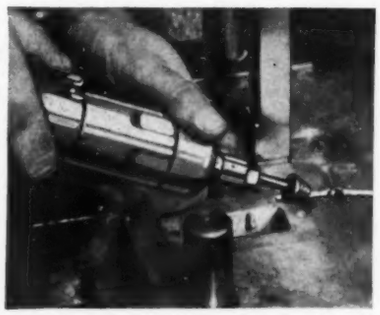
A drill which is said to cut through intensely hard and very soft metals with equal facility is announced by Enesay Tool Co., 2240 Sepulveda Blvd., Los Angeles 25, Calif. Steel hardened to 68 Rockwell C can be drilled.

The drill is constructed of a new alloy which makes possible the penetration of hardened steel without impairing the metallurgical properties of the metal, according to the manufacturer. Metal removed during drilling is softened, but the surrounding metal remains unaffected.

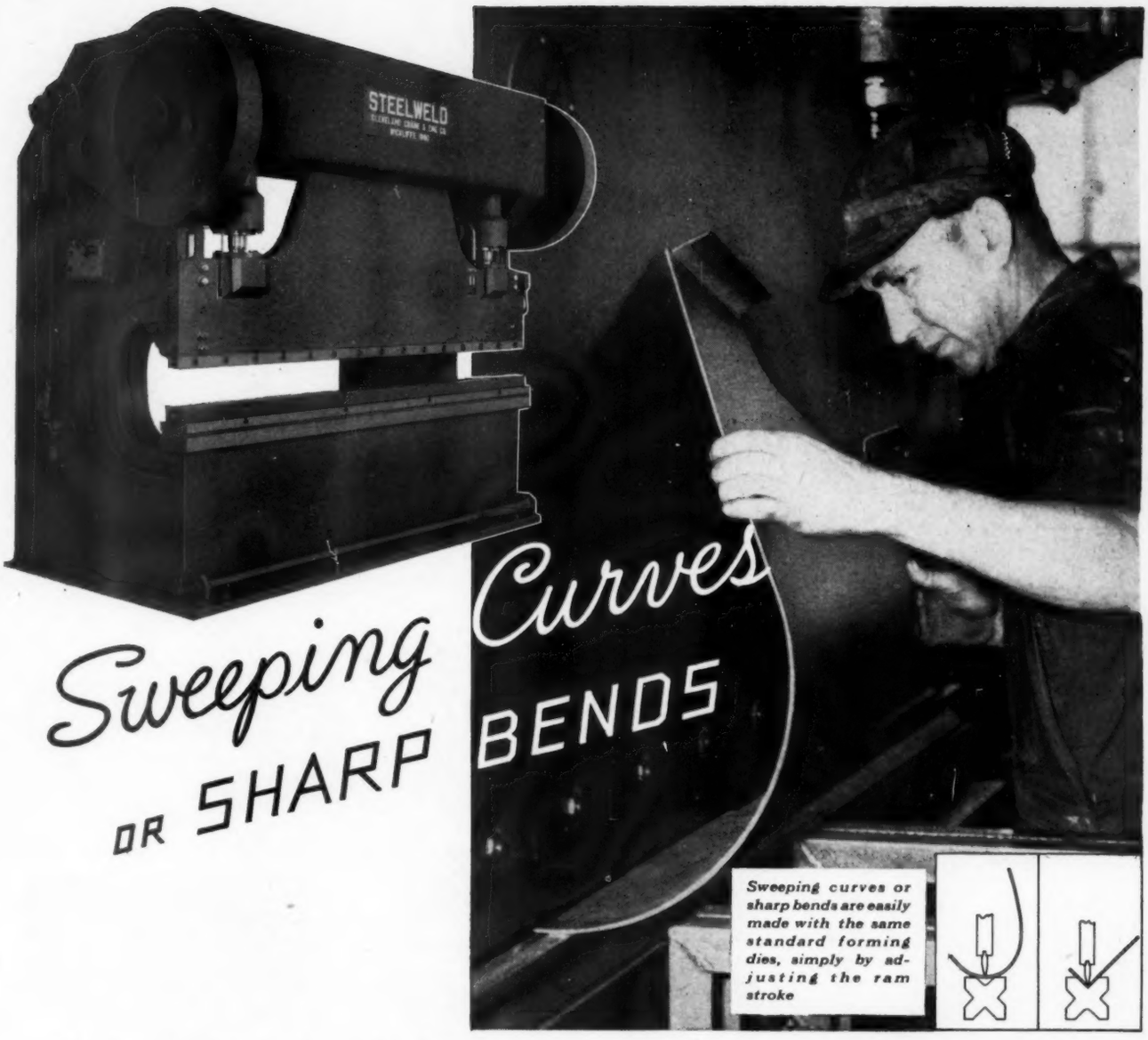
Tensile strength of the drill, available in standard sizes, is more than 45,000 psi.

Ideal Pneumatic Grinder Uses A Vane-Type Motor

A small pneumatic file and die grinder, weighing 16 oz., is announced by Ideal Industries, Inc., 1057 Park Ave., Sycamore, Ill., as part of its "Air Horse" line.



A vane-type motor is used which is said to maintain its speed even under heavy loads. Dust and chips are blown away by the exhaust of air from ports at the chuck end of the grinder. Wheels up to 1½-in. diameter may be handled by the grinder.



Sweeping Curves OR SHARP BENDS

Sweeping curves or sharp bends are easily made with the same standard forming dies, simply by adjusting the ram stroke

For decades plate has been sharply bent — or curved — corrugated — punched — and formed into various shapes. But can you think of any ONE method or machine prior to the development of the bending press, that could perform all of these operations speedily and easily?

In this modern world where efficiency is becoming ever more important, no one working with plate in thickness up to an inch can afford to be without a bending press. As applied to metal forming, it is a lathe, a shaper, a planer, a boring mill and drill press, all rolled up into one.

Sweeping curves and sharp bends are only a few of the many operations that can be performed on a Steelweld. With dies available, and simple ones that are easily made, the kinds of work that can be produced are practically limitless.

Now, more than ever before, it is important that you be keyed up to do all kinds of forming work with dispatch and accuracy. We urge you to get the facts on this modern tool.

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CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

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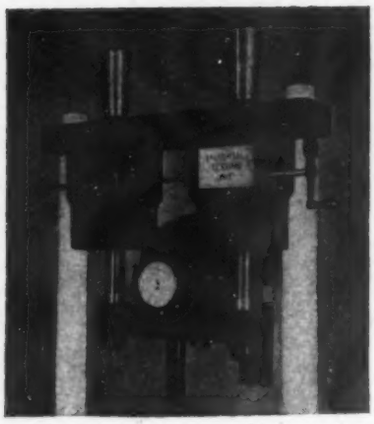
BENDING PRESSES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

Universal Rockwell Test Unit Checks Large, Heavy Pieces



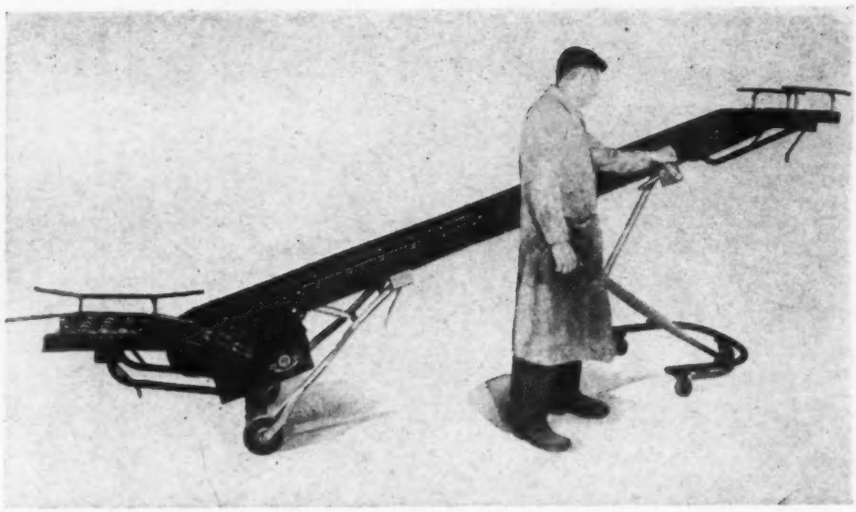
A universal testing unit for heavy or large work which cannot be handled in standard Rockwell hardness testers is announced by Wilson Mechanical Instrument Co., Inc., 383 Concord Ave., New York, N. Y.

The unit is mounted in a rigid supporting frame designed to suit the particular application. The phantom frame shown in the illustration is a test frame and is not intended to illustrate an application.

PowerOx Electric Lift Truck Will Turn Through 270°

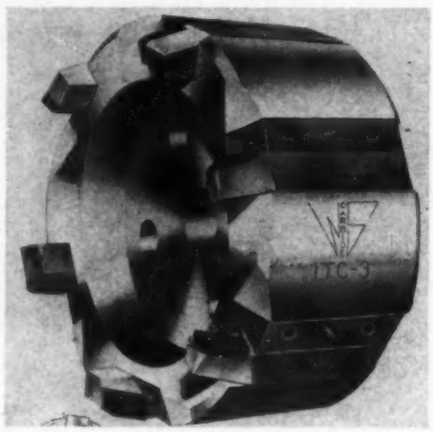
An electrically operated lift-truck, the PowerOx, is announced by Barrett-Cravens Co., 3255 W. 30th St., Chicago 23, Ill. The 4-in. vertical lift can be accomplished in 4 sec. with a hydraulic gear pump connected to the electric motor.

The unit has two speeds forward and two in reverse with the handle in any position. Steering is through a 14-in. dia. turntable which can be turned with full power through 270°.



CABLE-LIFT DEVICE—Stevedore, Jr. portable power belt conveyors now have a cable-lift device for elevating the head end. Adjustment is made by turning the lifting handle. The accessory can be added to units already in use. Made by Rapids-Standard Co., Inc., Grand Rapids 2, Mich.

Blades Are Interchangeable On Wendt-Sonis Milling Cutter

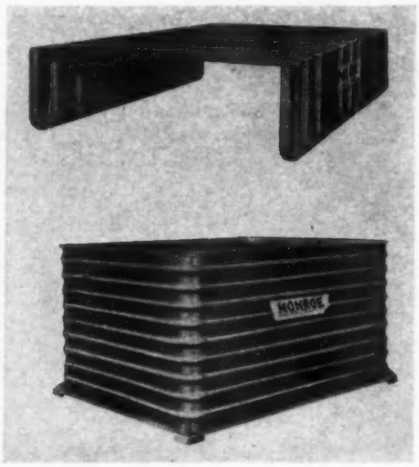


An inserted-tooth carbide cutter, with blades interchangeable for any type of milling job, has been introduced by Wendt-Sonis Co., Hannibal, Mo. A cutter is said to require less power than ordinary cutters.

A wedge prevents blades from slipping out while in operation. When sharpening is necessary, the blades may be removed from the cutter body and ground on an ordinary bench grinder.

Weight Saved in New Monroe Material Handling Equipment

The use of high-tensile steel results in substantial weight saving in a new line of material handling equipment announced by Monroe Auto Equipment Co., Monroe, Mich. A 42 x 60 x-12-in. basic platform skid without runners weighs 155 lb. in 11-gage tensile steel, compared with 234 lb. with the 7-gage hot-rolled steel previously used.

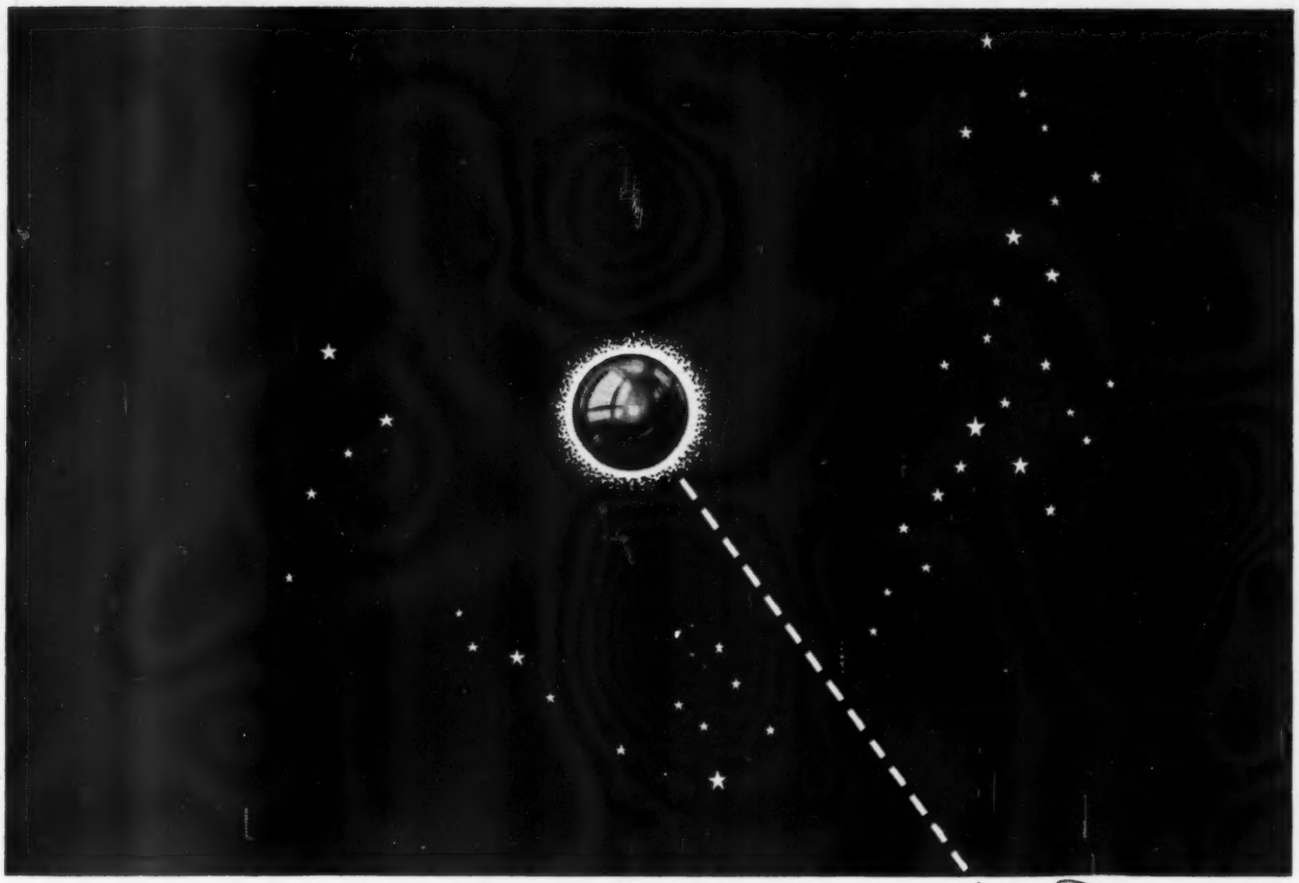


The line consists of six basic units in standardized sizes. They include basic platform skids, nestling rings, platform boxes, wood and steel platform skids, wood and steel pallets, and steel pallets.

Correction

A cipher got lost in the report of the sapphire-tipped micrometers made by Sapphire Products Div., Elgin National Watch Co., Aurora, Ill., which appeared in a recent issue. The article should have stated that the accuracy of the micrometers is guaranteed to 0.0001 in.

NATURE'S FAVORITE, STRONGEST FORM



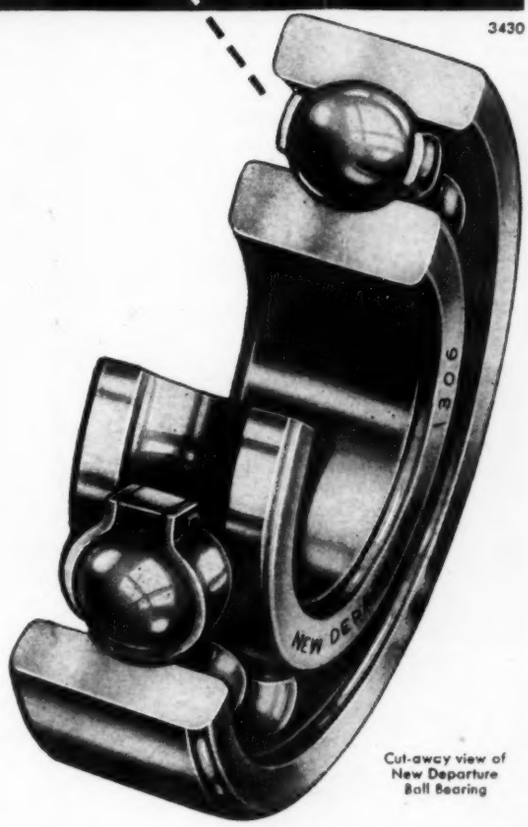
3430

. . . is put to work in New Departures . . .

The New Departure Ball Bearing licks friction with free-rolling, tough, forged steel balls.

It is uniquely fit for today's high speeds, heavier loads —and precise positioning requirements.

This, plus meeting Industry's problems with *original thinking*, has made New Departure the world's largest manufacturer of ball bearings.



Cut-away view of New Departure Ball Bearing

Nothing Rolls Like a Ball

NEW DEPARTURE

BALL BEARINGS

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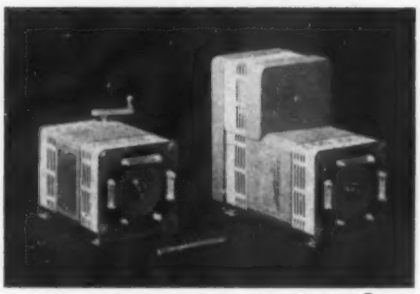
Parts and Materials

Liquid-Tight Conduit Built To Carry Machine Tool Wiring

A synthetic-covered shielding conduit designed specifically for use on machine tools is announced by Chicago Metal Hose Corp., Maywood, Ill. Designated Rex machine-tool conduit RT-25, it is designed to the new machine tool electrical standards.

The conduit has a galvanized-steel flexible metal hose liner and synthetic cover. It is liquid tight externally, can be used with both standard and water-tight conduit boxes. The hose is furnished with fittings which are attachable and re-attachable by the user or which can be permanently attached at the factory.

General Electric Extends Line Of Induction Voltage Regulators



An extended line of dry-type induction voltage regulators to include 300 and 600 volt-ampere ratings, has been announced by the Transformer Div., General Electric Co., Schenectady 5, N. Y.

The new Inductrols are available in a hand- or motor-operated design for providing a variable-output voltage from a relatively constant supply voltage, and an automatic design for maintaining closely regulated output voltage from a varying supply voltage. Applications include the heat control of electric furnaces, and motor speed control.

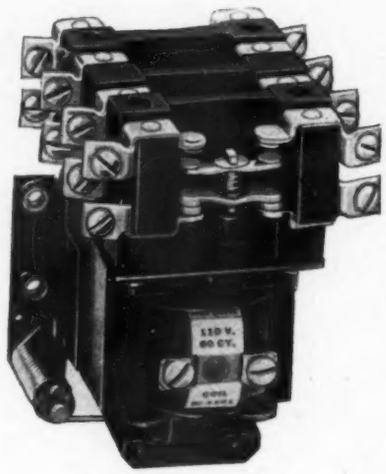
Losses are low as the Inductrols operate at autotransformer efficiency, and the absence of brushes practically eliminates radio interference and cuts maintenance to a minimum.

Plastic Protective Coating Applied at Room Temperature

A protective coating that is applied at room temperature, Plastipak, is announced by Puritan Co., Inc., Rochester 6, N. Y. It is a resinous compound that dries in air to form a clear, tough, elastic, transparent or colored film.

The coating can be applied by dipping or spraying. It can be stripped off in a continuous sheet when desired. The coating has been applied to metal parts, cutting tools, gears, drills, taps, axes, as well as to sheet metal, wood products, glass, and porcelain. The material provides moisture protection and has insulating properties.

Allen-Bradley Solenoid Relays Can Be Normally Open or Closed



A new line of universal-type solenoid relays has been developed by Allen-Bradley Co., 1311 S. First St., Milwaukee 4, Wis. Flexibility is provided so that a simple shift of connections permits changing normally open contacts to normally closed, or normally closed to normally open.

Contacts on the 2-pole and 4-pole relays are all of the universal type. The 6- and 8-pole relays have four sets of universal contacts.

Callite High Density Alloys Made by Powder Metallurgy

A series of high density alloys, known as Dense Alloy, 112, has been developed by the Callite Tungsten Corp., Union City, N. J. The alloy is available in three types.

Type P is largely tungsten, copper, and nickel; type E tungsten, cobalt, and silver; and type Y tungsten, cobalt, and nickel. In each case there are small percentages of other alloying ingredients. The alloys are said to be especially adaptable for use as balancing weights and to be readily machinable for precise balancing.

The alloy is produced by powder metallurgy and is available in round, square, and special shapes.

Your automatic screw machines will operate longer between tool changes when you use J&L Cold Finished steel. The uniform Controlled Quality of J&L Cold Finished rounds, hexagons and squares makes it possible for you to set the speed of your machines to obtain maximum efficiency. In addition the close dimensions and inherent machinability of J&L Cold Finished bars will make it possible to produce, at low cost, accurate, highly finished parts.

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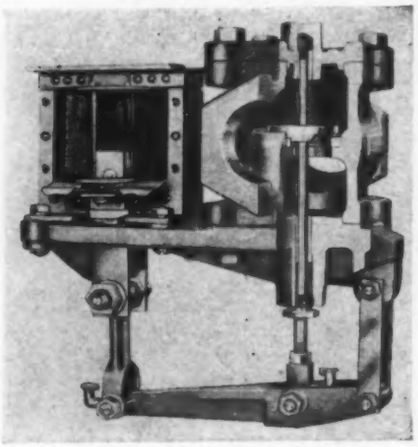
PITTSBURGH 30, PENNSYLVANIA

J&L STEEL

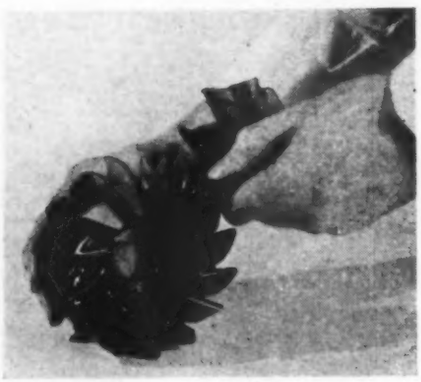
Johnson Corp. Solenoid Valve Controls Hot Liquid or Steam



A direct-acting solenoid valve combining immediate full flow with the ability to operate under differential pressures as high as 150 lb. is announced by the Johnson Corp., Three Rivers, Mich. It will handle hot liquids or steam up to 365 F.

In normal position the valve is closed; opening when the solenoid is energized. Body of the valve is of cast iron or bronze, with the valve, seat, and stem of stainless steel.

Barber-Colman Protects Tools With Transparent Coating

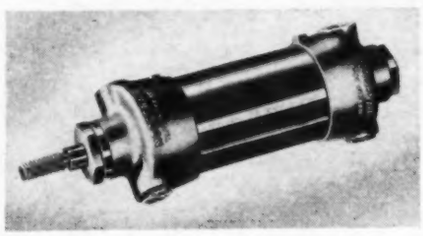


A transparent, ambercolored cellulose compound, "Protecto-Coat," is being used to protect cutting tools by Barber-Colman Co., Rockford, Ill. The coating is applied by dipping the tool in the heated compound.

Protection for the cutting edges during shipment and storage, as well as safer handling, are obtained. Because of the transparency of the coating, tools can easily be identified and it is unnecessary to remove the coating until the tool is to be used. It can easily be removed by slitting the coating and peeling it off.

INSULATION TESTER—Insulation resistance is checked with this self-contained test unit made by Ideal Industries, Inc., 1057 Park Ave., Sycamore, Ill. Power is provided by an internal generator operated by turning the crank on the tester. Used for periodic check of motors, it will detect a weakness before a breakdown occurs

Pipe Connection to Cylinder Is Easier With Rotating Cap



A cushion-type cylinder for air, water, or oil with interchangeable mounting methods is announced by Modernair Corp., Oakland, Calif. The cap can be rotated a full 360° on the cylinder without disturbing the seal, permitting simplified pipe connections.

Mounting brackets available include end plate, foot bracket, and swivel mounting. Various combinations of these brackets are possible.

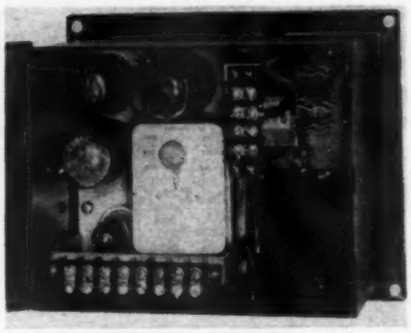
Solvent Mixed with Water Soil Floats; Is Skimmed Off

A self-emulsifying, water-miscible solvent, Composition No. 98, is announced by Oakite Products, Inc., 22 Thames St., New York 6, N. Y. Used to remove light shop dirt and non-pigmented stamping compounds from steel and aluminum, it is for use in pressure-spray washing machines.

The lighter-than-solution soil floats to the top of the cleaning tank which is said to protect the cleaning solution underneath, retard foaming, and prevent loss by evaporation. This layer is periodically skimmed or removed by overflowing the tank to avoid excessive thickening. The solvent is said to prevent formation of water spots on work, which often show through lacquer.

Composition 98 is used in concentrations from 1 to 2° by volume at temperatures below 150 F.

Ashcroft Thermal Protector Shuts Off If the Power Fails



A thermocouple-actuated limit switch, the Ashcroft Thermal Protector, is announced by Manning, Maxwell & Moore, Inc., Bridgeport 2, Conn. The unit is intended for protection of ovens, dryers, large bearings, injection presses, and other equipment.

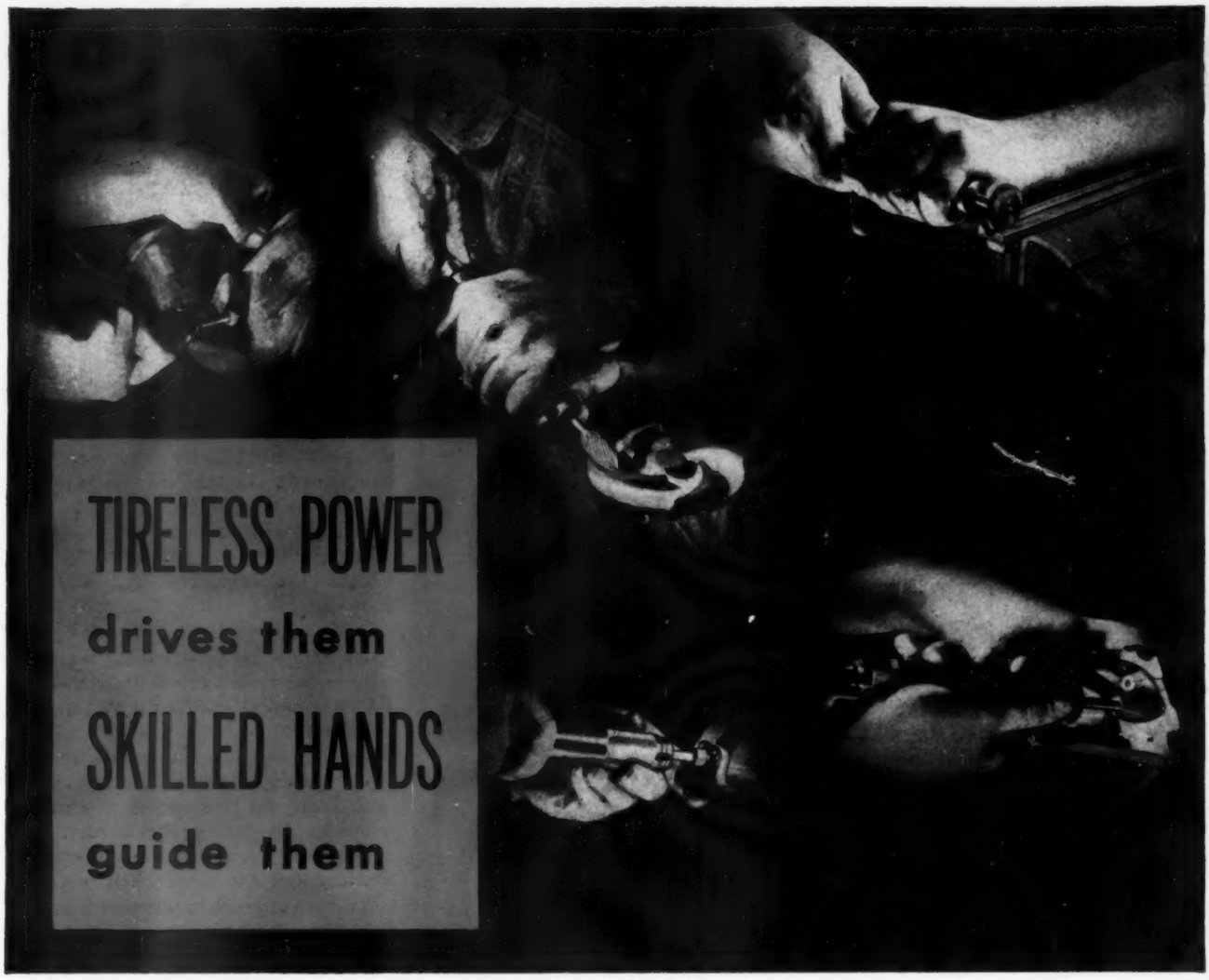
When the temperature limit set on the operating knob is reached, the unit will stop the apparatus. If the thermocouple is burned off or broken, or the power supply fails, the protector automatically shuts off.

The protector is designed with two ranges, 100 to 1000 F. using an IC couple, and 800 to 2000 F. using an AC couple.

Ampcoloy Nickel Silver Alloys Made for Food Processing Use

A series of stainless white alloys, Ampcoloy Nickel Silver, containing 20 to 30% nickel, has been developed for use in food processing equipment by Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4, Wis. Four grades are regularly available including, in addition to the nickel, small amounts of tin, manganese, iron and lead, with the balance copper.

Ampcoloy 595 is 20% nickel, 540 is 30% nickel, 590 is 22% nickel, and 591 is 25% nickel. The alloys are highly corrosion and acid resistant, and when properly finished may be easily cleaned. Precision machining is possible and the alloys may be cast by sand or centrifugal processes.



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Burring, enlarging and elongating holes, removing scale and fins, breaking and chamfering corners, smoothing interior or concave surfaces —these are some of the jobs they handle in die sinking, metal pattern making, mold finishing, tool and jig making, finishing intricate parts for innumerable uses.

The prerequisites to maximum performance in rotary files are: High-quality high-speed steel; keen, accurate cut; "no wobble" (true-centered shaft and perfect radius at all cutting circumferences).

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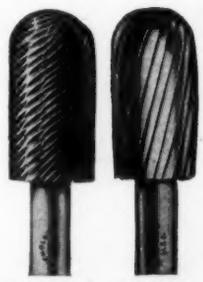

HAND CUT GROUND

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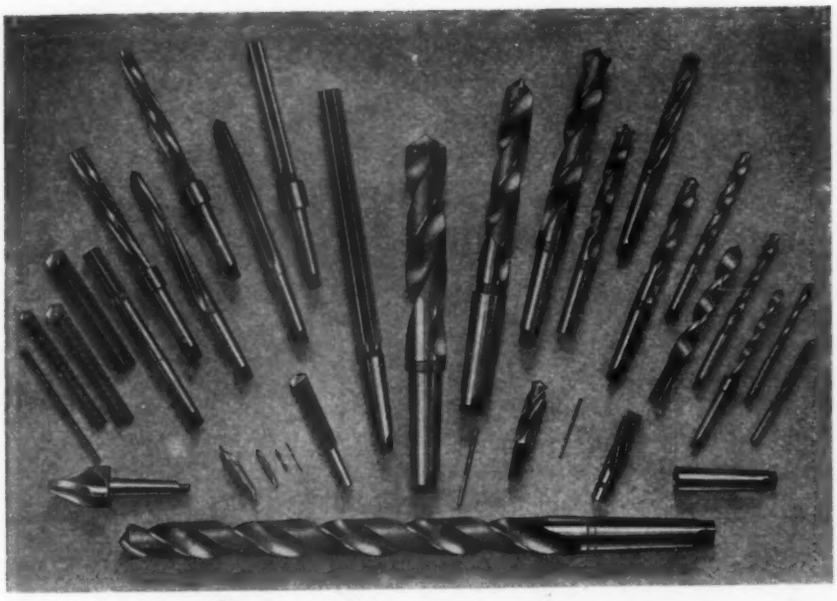

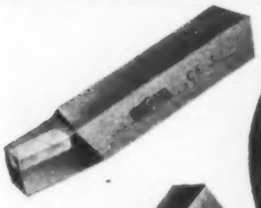

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ROUND TABLE *Discussion*

MOUTHPIECE OR MANAGER?

A foreman is not a foreman in the true sense of the word when he is a "yes man." Wise and experienced employers and managers shy clear of the "yes man" types. Such foremen, however, should not be confused with the sincere and loyal foremen who stand behind their superiors.

A competent foreman should have complete disciplinary rights in his department. He should fall in line with his company's policies and should offer alternative methods for consideration if he believes they will benefit the company and its employees.

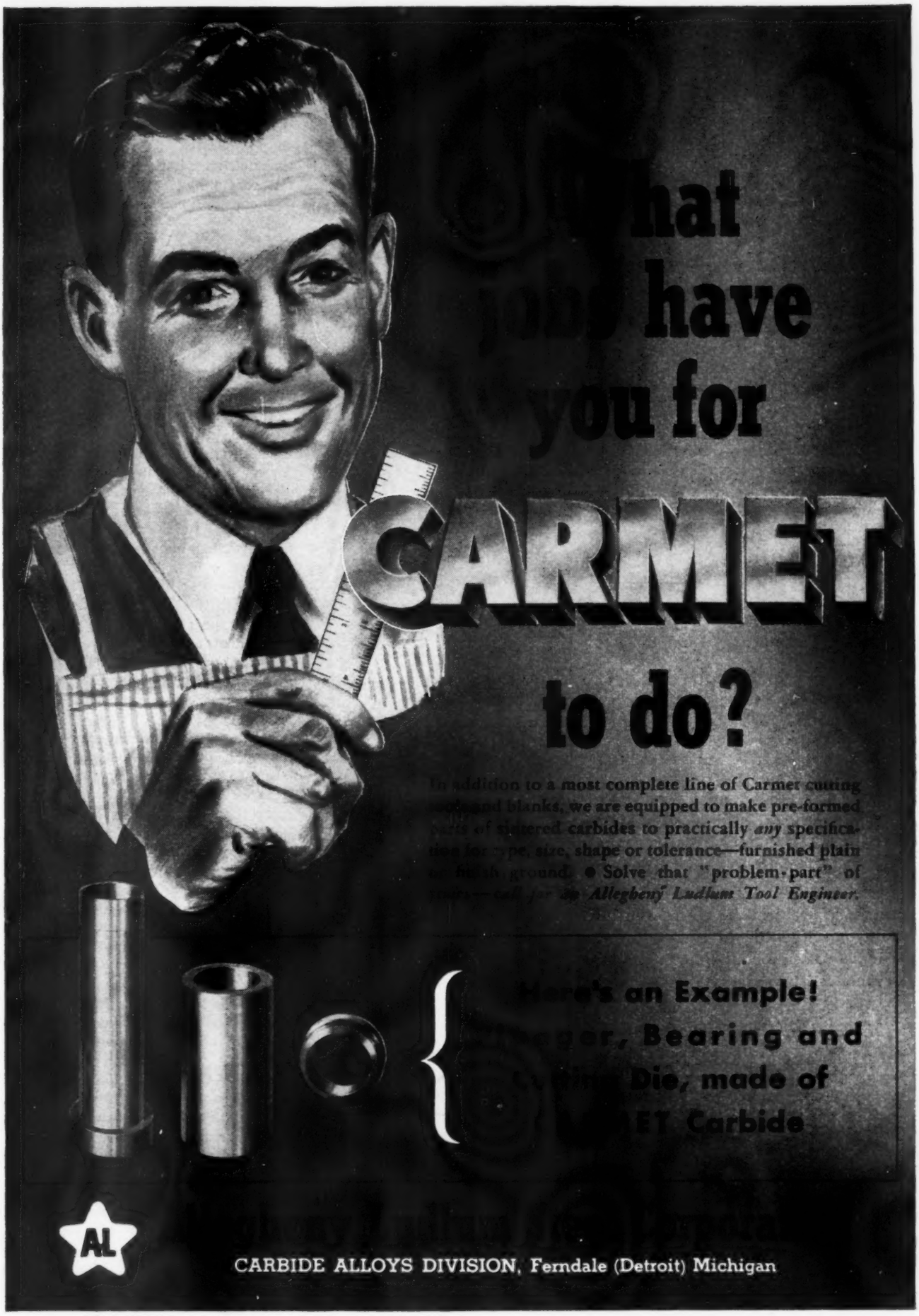
Service departments, where they exist, should be accepted by the foreman without demur, so long as they do not undermine his authority in the matter of shop discipline. Inspection, maintenance, planning and progress departments should all be welcomed by the good production foreman as easing his burden and giving him more time to improve organizational and production methods.

To turn a good production foreman into a work chaser is a short-sighted policy and bad management. Less skilled and lower paid progress clerks can do the work just as well. The foreman's duties come into the managerial category, and to employ his skill and experience at a lower level is merely squandering them.

General supervision touches the foreman's job at so many points that only the most important can be cited here:

1. Selecting the man for the job can be a profitable activity in the company's interest and a source of satisfaction to the employees. Square pegs are usually uncomfortable in round holes, and production suffers in quality and quantity. For training purposes, assistants should be encouraged to select the man for the job, but the foreman should be continually reviewing the results in the light of his wider experience.

2. Setting up, tooling, and cutting feeds and speeds are so vital, especially on variety production, that no responsible foreman can afford to leave such matters entirely to assistants. The methods employed last year may not be best for the same job this year; the tools and even the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machine last employed may be improved upon.

3. Intelligent use of materials and tools, training of apprentices, care of machines, idle time, timekeeping, safety first, etc., all demand a watchful eye from the foreman, notably in medium-sized general production shops operating in a highly competitive market where profits do not permit carrying a staff of specialists of any considerable size.

C. D. Mackinnon
Lanarkshire, England

•

The question above is one of ever-increasing importance. As one who in the past has been, at different times, on both sides of the situation, and is now directly on neither, the writer may claim to be unprejudiced.

Taking the problem as it stands, one must sympathize with Ed. There is nothing more infuriating for a foreman than to have a man short-circuit him. A boss who permits such actions is not worthy of the name.

Industry today is so complicated that establishment of specialized "administration services" departments is inevitable. They must, however, be subject to the production department and not permitted to assume direct control of any of its functions. In other words, these special sections must exercise their functions *through* direct supervision, and not over or around it.

If the general manager, personnel manager, or any other executive is going to give a department employee time off without consulting the foreman, then the latter certainly cannot be held responsible for either production, cost or quality. In hiring men, the employment department should not be in a position to compel a foreman to take on a man. If the department holds full sway in hiring, then the foreman cannot be held responsible for results.

The whole problem really boils down to broadmindedness on the part of the foreman combined with tact and an ability to understand the foreman's viewpoint on the part of administration service departments. If these departments remember that the only justification for their existence is the service they can render to improve production, quality and cut costs, then they are unlikely to overstep their functions.

The older type of foreman who in the past exercised much wider authority than at present, is naturally inclined to resent curtailment of his functions. But if he reviews the situ-

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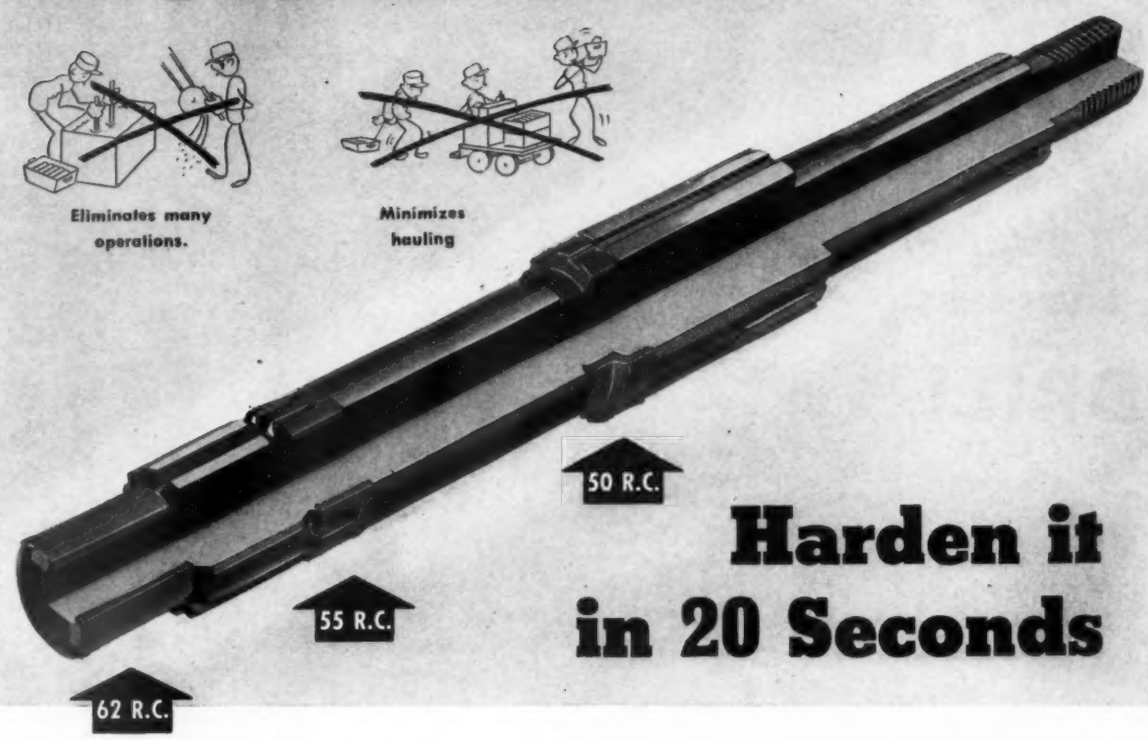

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ation dispassionately, he will realize that this curtailment allows him more time to get down to the real problems of improving production methods and thus improving quality and reducing costs. His gain far outweighs his loss.

K. N. Harris
Wealdstone, Harrow
England

•

Every foreman is a manager in his own right. He should manage his own department personnel. Today with labor conditions as they are, this in itself is a big problem. The flow of information to the workers should, without question, always come from the foreman. If he is being bypassed he should certainly take the problem up with his superior.

Foremen in successful businesses today do have advisors on special items such as personnel problems, safety and plant maintenance. However, the foreman should not feel that these service departments are taking the glory out of foremanship. Let him analyze the fact that plant managers, vice-presidents, and even company presidents have advisors on special problems.

True, in the "good old days" when labor could be had for a song and business was slow compared with today's high-production, low-cost operation, the foreman ran the shop. His thoughts, however, were divided among many problems and he could not concentrate properly on any one. The saying "two heads are better than one" surely applies to plant operation.

A foreman is to the worker what the president of the company is to his board of directors. Both are expected to lead and both have a responsibility to the working public.

Charles Delmar Townsend
Cleveland, O.

•

DO MACHINES MAKE JOBS OR TAKE THEM?

The Round Table discussion between Al and Ed on this subject brings nostalgic memories of the past 50 years in the machine shop. I have argued this point consistently on the side that automatic machines make jobs and, in fact, have made this country the greatest industrial nation on earth.

I can remember back to the days when the basic automatic machine of all was introduced — the automatic screw machine. Union hand-screw machine operators went on strike, claiming that these machines would

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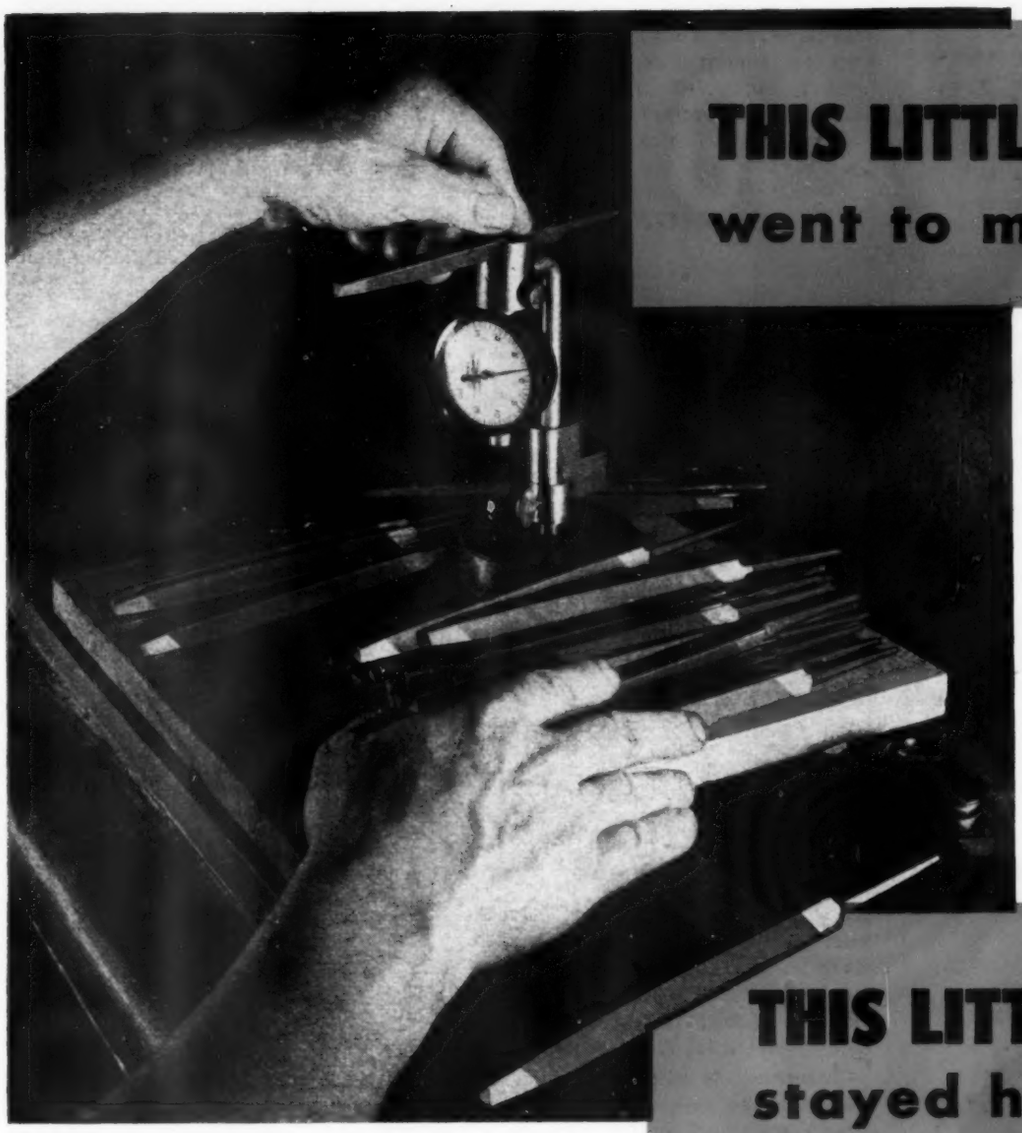

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The testing operation illustrated above is one of many. Here, for example, triangular files are being checked, one by one, with a dial gauge to see that edges are uniformly correct in width.

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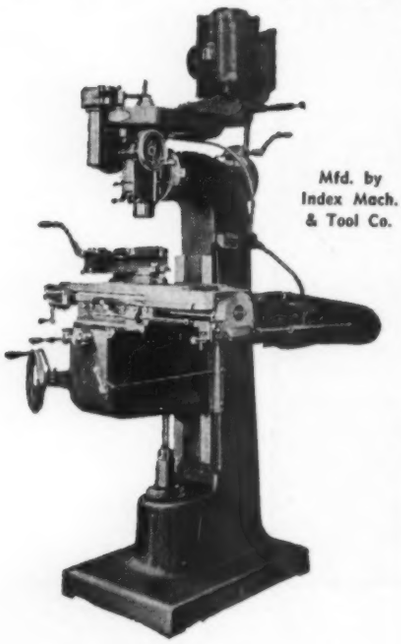

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A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

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put them all out of business. There were only a few thousand operators in that line at that time, while now there are hundreds of thousands.

Before the automatic screw machine was developed, the average price of a bicycle was about $375. Within two years the price went down to about $125, while the number of employees in the cycle factories rose from 4,000 to over 400,000. Only an ignoramus or a union organizer would claim this machine threw men out of work.

Had it not been for the skill and know-how of the cycle industry, the great auto industry would never have been developed to the point it is today. We would have had autos, of course, but what would have been the prices? If autos had had to be made by the old hand-fitting methods, just how many workmen would be able to drive them? Where would be the comfortable homes of our workingmen, with refrigerators, washing machines and hundreds of other labor-saving devices now so common?

I fail to see where there can be any argument on this question. It is so self-evident that no intelligent person can fail to see it.

Hats off to the daddy of all automatic machines—the automatic screw machine—the precursor of American preeminence.

Lee L. Dodds,
Kent, Wash.

•

IS RABBLE-ROUSING WORTH A PREMIUM?

Cleverness is not always an asset as it can be and is used in promoting both good and evil deeds.

One who is capable of speaking in a clear and, to his listener, a convincing manner almost always gets a first chance. But if his acts do not hold up to his promises, or if his promises are not offered in fairness to all concerned, he is soon found out and his rating drops accordingly.

Too often voters casting ballots for leaders both in industry and politics pay too little attention to high principles and fairness to all concerned. They are blinded by liberal promises to their special group.

Discontent of an individual in the service in which he is engaged is frequently caused by his not being in the line of endeavor for which he has a liking and the most natural talent.

Contentment in one's line of work goes a long way, and one should make every endeavor possible to place himself where he is best adapted.

Martin H. Ball
Watervliet, N. Y.

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described and demonstrated in this practical manual

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TIME STUDY ENGINEERING

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William H. Schutt Associates, Detroit

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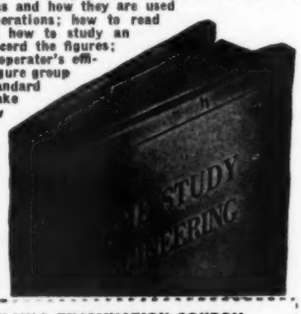
The book shows the whys and wherefores of time study work, reviews the arithmetic needed, tells step by step how to carry out a time study and gives a wealth of information on the machines and processes of industry, what the time study man should know about their construction and operation, and the special factors of taking time studies on each. Twenty-eight specimen studies on specific machines and operations are shown and fully discussed in the text.

- **gives 26 time-study charts; each from an actual observation in industry.**
- **describes machines and operations and their time-study factors.**
- **emphasizes factors of economical production and fair standards for the worker.**

Covers: Fundamentals of time study, requirements of work, equipment and how it is used, etc.; the basic motions and how they are used in analyzing operations; how to read the stop watch; how to study an operation and record the figures; how to rate the operator's efficiency; how to figure group bonus and standard hours; how to make process or flow charts, etc.



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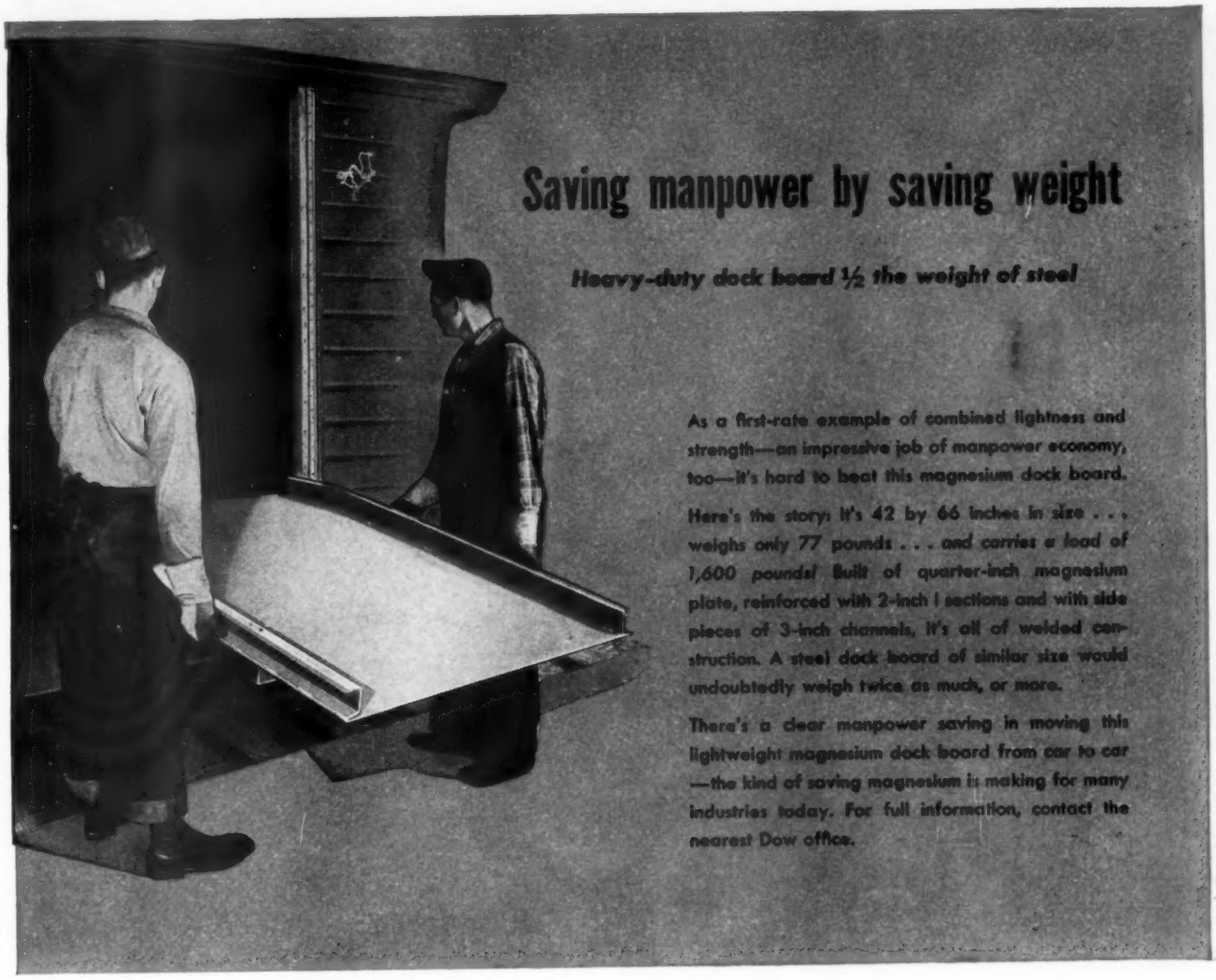

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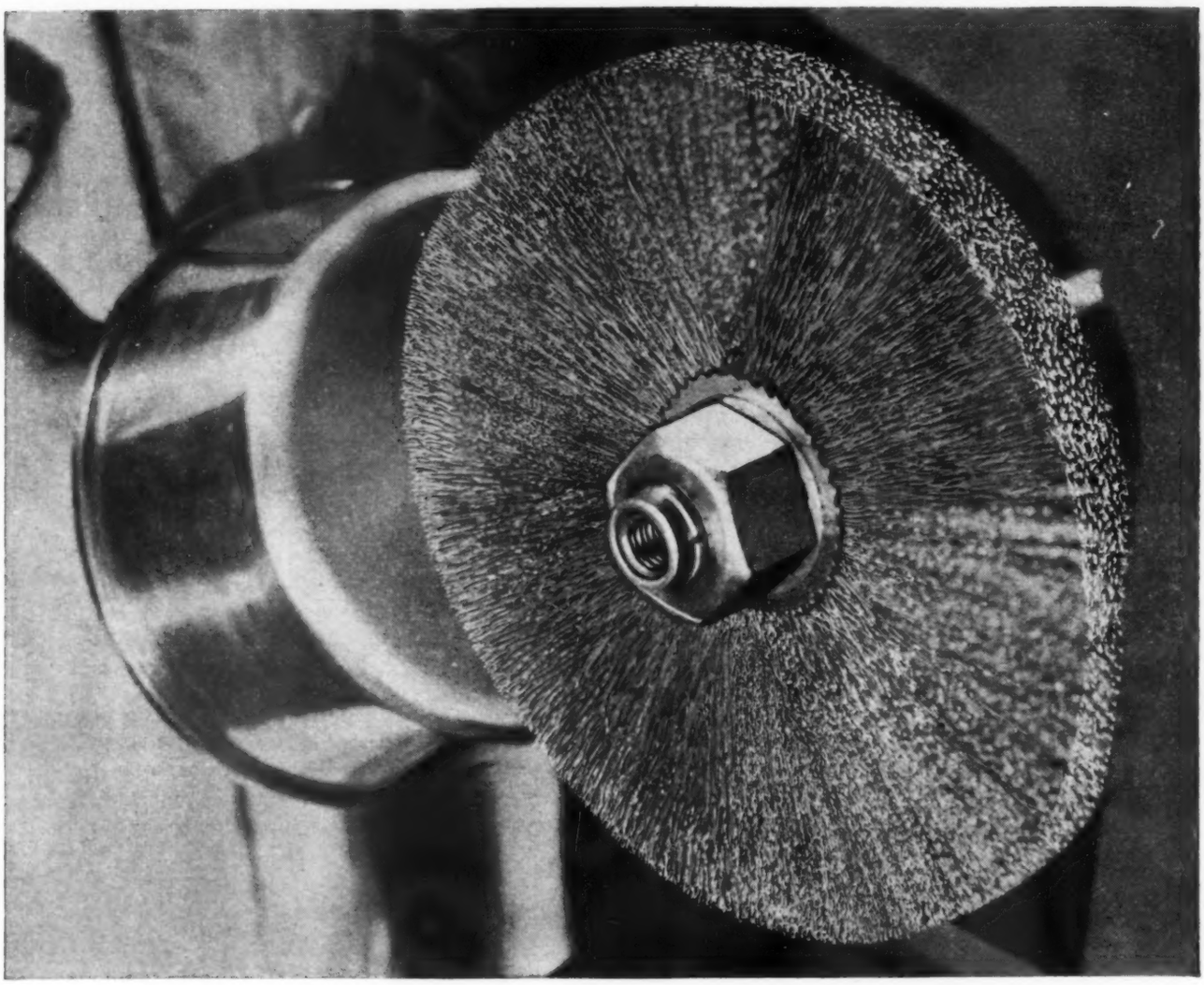

IT ALL STARTS WITH S.A.*

No matter what you make, if you want it to be a best seller, you've got to give it *Sales Appeal.

One way to increase sales appeal, according to a leading manufacturer of aluminum kitchenware, is to give the product a final brush-up with Osborn Economy Wheels. These fast, flexible brushes produce a beautiful satin finish on flat and curved surfaces and, unlike other types of polish finishes which exaggerate minor surface flaws, these brushes completely and uniformly cover them. They add another sales plus, too: heat conductivity has been improved because the surface area has been increased.

No matter whether you make cooking pots or locomotives . . . no matter whether your product's made of aluminum, steel, plastic or other materials—brushing techniques as developed by Osborn can help you make your product better-looking, better-performing and better-selling.

Why not ask us how—now! Without obligation, of course.

New Booklet available! When and where to use power brushes and how to select them. Write for your copy today.

THE OSBORN MANUFACTURING COMPANY
5401 Hamilton Avenue *Cleveland, Ohio*

Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

NEW!

DISSTON SAFETY REEL

FOR FLEXIBLE-BACK METAL-CUTTING BAND SAWS

An important handling problem solved by a Disstoneer

1. Grip clip between thumb and forefinger of left hand . . .

2. Pull out band saw with right hand . . .

3. Cut off length desired . . .

4. Push clip back to end of saw. The entire operation takes but a fraction of a minute—and it is *safe*.

Anyone who has ever handled a band saw coil knows that the operation can be as dangerous as uncoiling a snake. With the slightest fumbling the whole roll may suddenly spring to life, go "haywire" and get completely tangled up and injure the operator. The job of coiling it up again is one not soon forgotten.

"Something should be done about it!" A Disstoneer* said that. Following his suggestion the Disston Safety Reel for flexible-back metal-cutting band saws was developed . . . changing a difficult and dangerous operation into one that's almost as simple as pulling out a length of metal tape rule . . . and with equal safety.

Another clear cut case of Disston leadership

ESTABLISHED 1840 REG. U.S. PAT. OFF.

HENRY DISSTON & SONS, INC.
620 Tacony, Philadelphia 35, Pa., U. S. A.

***DISSTONEER**—a man who combines the experience of Disston leadership and sound engineering knowledge, to find the *right tool* for you—to cut wood, to cut metal and other materials—and TO CUT YOUR COST OF PRODUCTION—*not only on special work but on ordinary jobs as well.*

The Disston Safety Reel for flexible-back metal-cutting band saws holds 100 feet of band saw. This is enclosed in a tough container which protects the saw and makes storage easy. All widths up to and including ½" are supplied on the new Safety Reel.

MAIL COUPON FOR FURTHER PARTICULARS

HENRY DISSTON & SONS, INC.
820 Tacony, Philadelphia 35, Pa., U. S. A.

Please send full particulars regarding the new Disston Safety Reel for flexible-back metal-cutting band saws.

NAME _____

POSITION _____

FIRM NAME _____

ADDRESS _____

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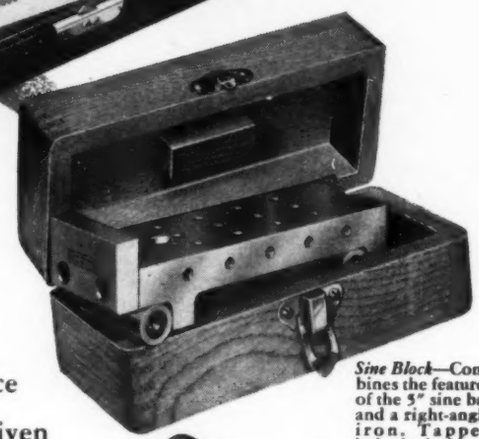
FOR TOP PRECISION

in measuring Angles and Locating Work

...use these TAFT-PEIRCE Toolroom Specialties

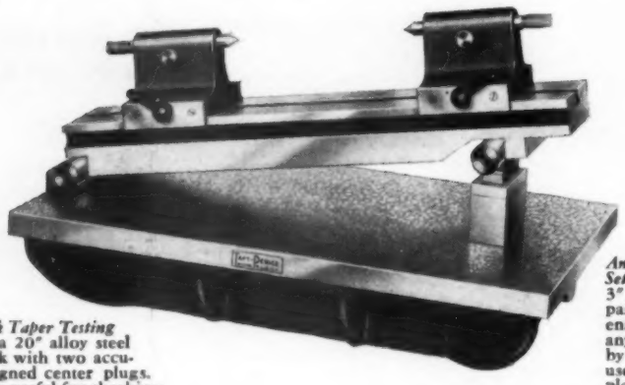
Sine Bar — For measuring angles accurately or locating work to a given angle within close limits. Available in 3", 5", 10", and 20" sizes.



Sine Block—Combines the features of the 5" sine bar and a right-angle iron. Tapped holes in the block simplify clamping of work.

Sine Bar Fixture — A sine bar, clamping device, and base constructed as a single integral tool. Available in 5 and 10" bar sizes. Invaluable in machining, grinding, and inspection departments.

Angle Block and Sine Bar Set — This set comprises a 5" sine bar and thirteen pairs of 4" angle blocks, enables the user to create any angle from 0° to 90° by ½° increments. Ideal for use on magnetic chuck face plate.

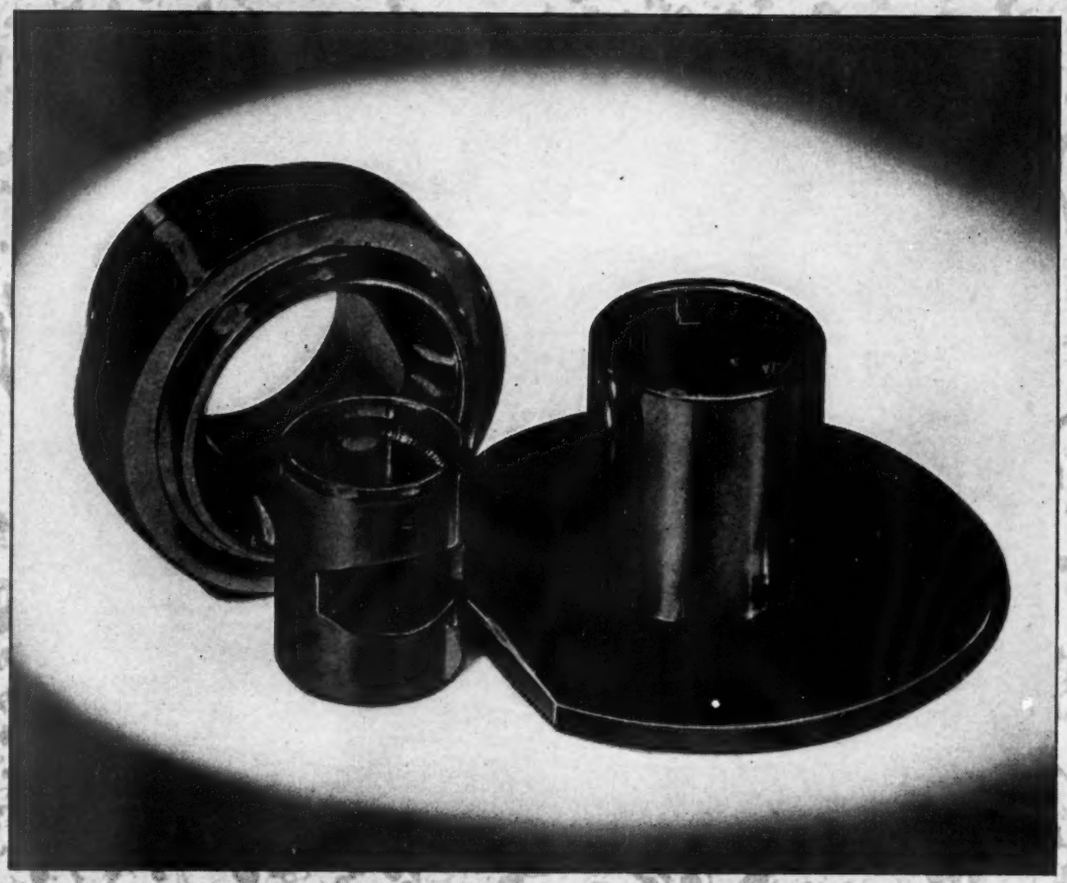


Sine Block Taper Testing Fixture—a 20" alloy steel sine block with two accurately aligned center plugs. Especially useful for checking tapers with extreme precision.

These tools are but a few of those available from Taft-Peirce stock for measuring angles and locating work to a given angle with the utmost accuracy. Tops in their field, they are a product of the Taft-Peirce Small Tool and Gage Division, and are indispensable for inspection and set-up departments in maintaining high standards of accuracy.

For further details of these and other angle-measuring equipment, write today for the new Taft-Peirce Handbook.

THE TAFT-PEIRCE MFG. COMPANY
WOONSOCKET, RHODE ISLAND



The quality of a Bunting Bearing is in the material, the accuracy and the fineness of finish. Special bearings made by Bunting to your print give you—with complete fidelity—exactly what you specify. Our engineers will be glad to work with you. The Bunting Brass & Bronze Co., Toledo 9, Ohio. Branches in all principal cities.

Bunting

48

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

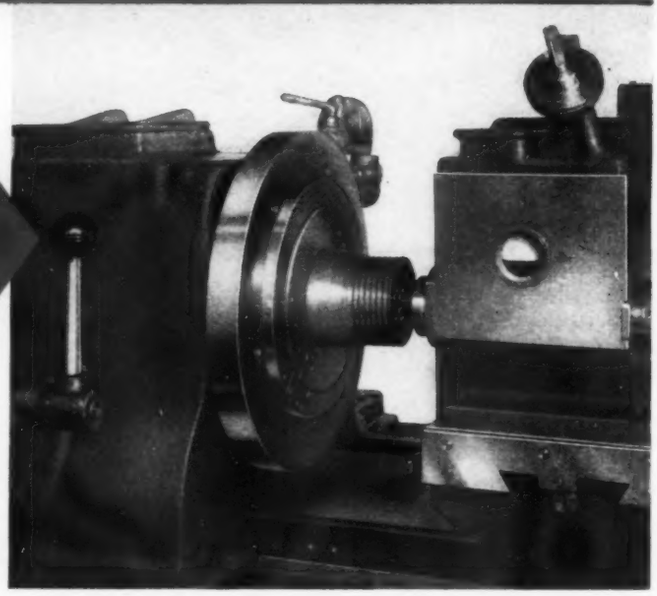
HERE IS ACTION!

FOR EXTERNAL THREADING

View showing set-up for External Threading. Changing from External to Internal, Right or Left Hand Threads is accomplished with ease and in but a few moments.

FOR INTERNAL THREADING

Typical set-up for Internal Threading. Insert the work and pull this lever: the machine does the rest and stops automatically, withdrawing the hob from the work, when the thread is completed.



• QUICK SET-UP
• FINISHED THREADS IN ONE REVOLUTION . . .

Simplicity of design for quick set-up plus the multiple cutter principle, account for the ability of Hanson Whitney Semi-Automatic Thread Millers consistently to produce threads faster, more accurately and more economically. These sturdy, high production machines cut internal, external or taper threads . . . right or left hand . . . with equal speed, facility and precision. Write for the facts—today!

Hanson Whitney

MACHINE COMPANY

HARTFORD • CONNECTICUT

Modern Machines Deserve Morse Couplings

Western Manufacturing Company of Detroit uses Morse Flexible couplings at all shaft-connecting points in their Model 9000-E transmission and secondary speed reducer.

Morse Flexible couplings—in either roller chain or silent chain design—are available in a wide variety of ***stock sizes.*** Data on larger sizes on request.

MORSE CHAIN COMPANY — Ithaca, N.Y. — Detroit 8, Michigan

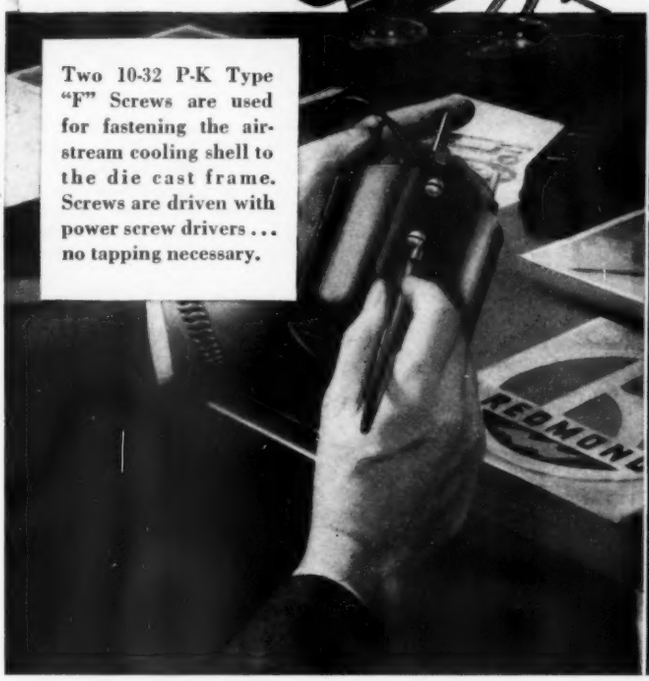
MORSE ROLLER and SILENT CHAINS

SPROCKETS • FLEXIBLE COUPLINGS • CLUTCHES

COMMON SENSE ASSEMBLY ENGINEERING

ELIMINATES THOUSANDS OF TAPPING OPERATIONS BY QUESTIONING FASTENINGS

. . . on the drafting board



Two 10-32 P-K Type "F" Screws are used for fastening the air-stream cooling shell to the die cast frame. Screws are driven with power screw drivers . . . no tapping necessary.

Three P-K Type "Z" Screws (filister head) attach the external oil catcher assembly to the frame. A steel guide is used on power screw driver to protect operator and speed up operation. Two Type "Z" screws fasten the internal oil catcher.

The Redmond Company Inc., of Owosso, Michigan could have assembled MICROMOTORS with machine screws. But Redmond design engineers wisely questioned fastening methods before assembly operations were started. Their conclusion: "It was obvious that P-K Screws would be less expensive to use." Why? Because seven time-consuming tapping operations in each motor could be avoided, tap breakage eliminated, and spoilage reduced to a minimum.

Today, every assembly step saved, every effort to employ highly paid hands to greater advantage helps to keep rising production costs in line. It is plain common sense to question your fastening methods . . . on the assembly line, or better still on the drafting board. If P-K Screws can be used, they will make a better assembly at worth-while savings – often from 30% to 50% – through the elimination of needless tapping, bolting, riveting, inserts in plastics.

Will P-K Self-tapping Screws answer your specific requirements? They do – in seven out of every ten assembly jobs submitted to us for consideration. Why not take the first step to find out – call in a Parker-Kalon Assembly Engineer – or mail assembly details for unbiased recommendations. Parker-Kalon Corporation, 200 Varick Street, New York 14, N. Y.

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P-K

PARKER-KALON SELF-TAPPING SCREWS

A FASTENING FOR EVERY METAL AND PLASTIC ASSEMBLY

When you need steel—remember this

Symbol of Service

WHEN you need steel, or have a problem of steel selection or application, our nine conveniently located warehouses are ready to serve you. At these points we make every effort to carry adequate, well-balanced stocks to meet your needs. No order is too small or too large—no inquiry is too much trouble—to be handled promptly, accurately and cheerfully.

Whatever your steel requirements may be—Hot Rolled or Cold Finished Bars, Structural Shapes, Plates, Sheets, Alloy Steel, Stainless Steel, Tools, Machinery, etc.—you'll get the best possible service by contacting our nearest warehouse. Phone, write or wire for quick, courteous attention.

LISTEN TO . . . the "Hour of Mystery" presented by United States Steel on the radio every Sunday evening. Consult your local newspaper for time and station.

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		REctor 2-6560 · BErgen 3-1614
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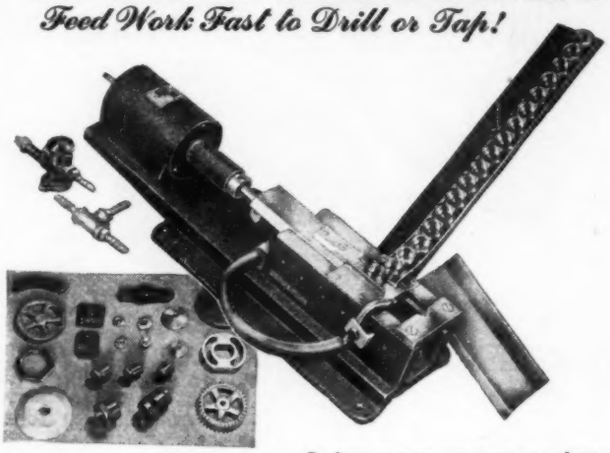
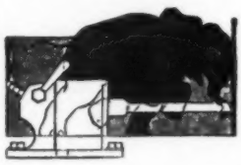
UNITED STATES STEEL

Boost Output with MEAD WORK FEEDERS

Feed Work Fast to Drill or Tap!



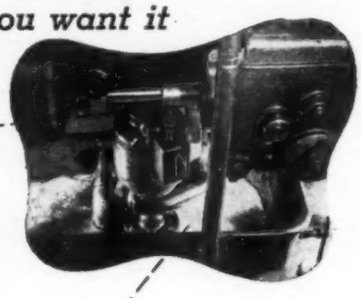
As-fast-as-you-can-step-on-a-button the sensational new Mead pneumatic WORKFEEDER delivers, holds, ejects small parts to be drilled, reamed or tapped. Accommodates stampings, castings, screw machine parts, etc. Adjustable to sizes up to 3". Foot automatic control; operator's left hand is free to keep hopper loaded. Write for new Mead AIR POWER Catalog describing "Mead Family" of air operated fixtures and devices.

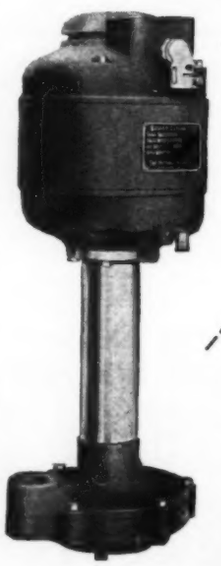


MEAD SPECIALTIES COMPANY
4114 NORTH KNOX AVENUE
Dept. MA-862 • Chicago 41, Ill.

Plenty of Coolant...

where you want it
when you want it





...if you specify
RUTHMAN GUSHER
COOLANT PUMP

Split second control of coolants from a trickle to full volume is just one of the many advantages of Gusher Coolant Pumps.

There is no priming, no packing, no leakage of coolants. When the Gusher is throttled you use less power.

For a coolant pump that will save both time and money, specify Ruthman Gusher Coolant Pumps on your machines.

MODEL TL7320

THE RUTHMAN MACHINERY CO.
1809 READING ROAD
CINCINNATI 2, OHIO
The "GUSHER"—A Modern Pump For Modern Machine Tools

BALLFLEX

ANGULAR AND AXIAL

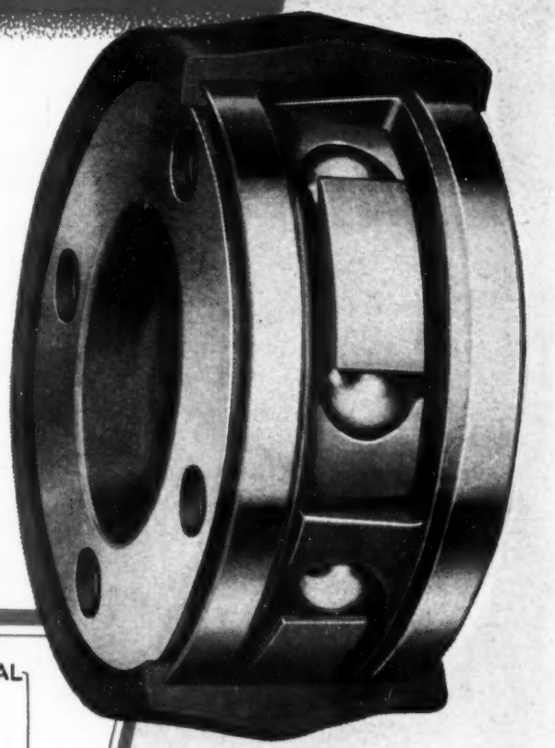
Anti-Friction Flexible Coupling

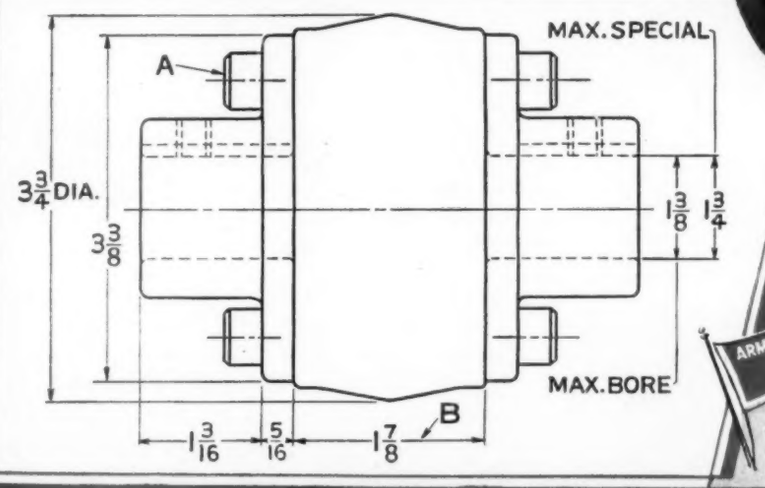
Ballflex provides flexibility—both angular and axial—by the rolling motion of hardened steel balls, insuring distinct advantages in performance as well as long life for both coupling and mounting bearings.

The load necessary to flex rubber and fibre discs or move sliding members—equalled by the reaction on mounting bearings—is one of the reasons for bearing and coupling failure, with subsequent down time.

Ballflex has no rubber or fibre discs—no sliding members. The only flexible element is the synthetic product used in the overall seal that retains the factory packed lubricant and keeps out dust, dirt and liquids, and is impervious to oil.

Free rolling movement in any direction eliminates side thrust and the bending or springing of parts. It accommodates parallel misalignment up to 1/8" and/or angularity up to 3°.





Ballflex requires no lubrication! It is packed with lubricant at the factory, for the life of the unit, and sealed.

Compact—Easy to Install

Ballflex is installed between two keyed flanges, spaced 1 1/8" apart for correct working clearances. Installation or removal accomplished without removing flanges or shafts.

ARMY NAVY

WRITE FOR LITERATURE

Contains full information and gives capacity ratings.

Manufacturers of

FORMSPRAG—full complement over-running clutches

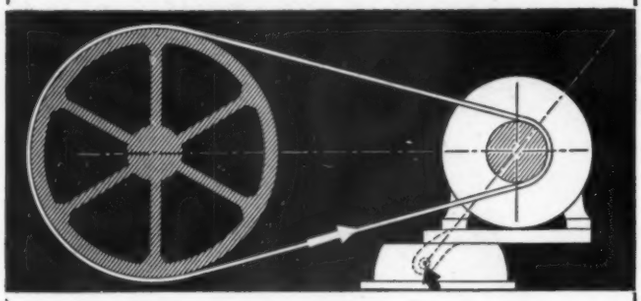
RZEPPA constant velocity universal joints

MACHINES for the Formed Wheel Grinding of gears, racks, splines and serrations.

The GEAR GRINDING MACHINE COMPANY

DETROIT 11, MICH. U.S.A.

7 YEARS OF CONTINUOUS SERVICE WITHOUT STOPPING . . . Except for Christmas Day . . . reports a big TANNATE-ROCKWOOD user.



TANNATE ROCKWOOD DRIVES Can Help You Too!

TANNATE flat belt short center drives assure correct belt tension—regardless of load, centers or unusual conditions, the weight of the motor maintains proper tension at all times. This means longer service life for your equipment.

The TANNATE flat leather belt has a very high coefficient of friction and great pliability that helps keep machines running at top speed. It is treated to resist moisture, oil and weak acids. TANNATE has unusually high tensile strength which contributes toward increased service life and reduced maintenance expense.

Motor base, one or both pulleys and belt are supplied by Rhoads. Designed to work together, they give superior performance. Maximum speed is maintained, and driven machine capacity is often increased when TANNATE-ROCKWOOD flat belt units are put on your drives. Get the most efficient and economical drives for your machines. Ask us for further details.

RHOADS
Tannate-Rockwood
SHORT CENTER DRIVES

Established 1702

J. E. RHOADS & SONS
35 North Sixth Street, Philadelphia 6, Pa.
NEW YORK • CHICAGO • ATLANTA

". . . thin nuts made thus, are especially superior."

That's only one of the many reasons why "Flexloc" SELF-LOCKING nuts will prove a wise buy. Just look at these advantages:

- It's all in one chunky piece and can, therefore, stand up under severe punishment
- Every thread—including locking threads—takes its share of the load
- Its construction is especially advantageous for maximum strength and dependability of thin nuts
- It accommodates itself to a very wide range of thread tolerances—from low #1 to high #3
- It can be used over and over again without losing its ability to lock
- It is not affected by temperatures likely to be met within the field of Mechanical Engineering
- Being a "stop" nut, it stays locked in any position on a threaded member
- It can be made of any of the conventional nut materials

Sizes from No. 6 to 1" in diameter; millions upon millions in use.

Write for Bulletin 582. The famous "Unbrako" Socket Screw and "Hallowell" Shop Equipment Products are also made by us.

"UNBRAKO" and "HALLOWELL" products are sold entirely through distributors.

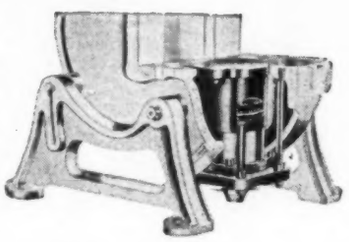
OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNSYLVANIA BOX 4

Boston • Chicago • Detroit • Indianapolis • St. Louis • San Francisco

+ INCREASED PRODUCTION
− REDUCED SETUP TIME
= DAYTON ROGERS DIE CUSHIONS

No matter how you figure it Dayton Rogers Die Cushions will assure better results and lower production costs on your punch press operations because:



1. They are readily adapted to either short run quantity requirements or for large quantity production.
2. They automatically convert a press from single action to double action for deep drawing work.
3. Correct pressure pad control on forming dies obtained quickly by simply adjusting the pressure regulator.
4. They afford positive stripping action on all compound, blanking and piercing dies.

Write for illustrated, engineering catalog #100-1

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Manufacturing Company
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ONLY TAPER-LOCK

IN TAPER BUSHED SHEAVES, ONLY TAPERLOCK

IS MADE IN DUAL DUTY SIZES

3.0" to 18.0" Pitch Diameter
1 to 6 Grooves inclusive

PLUS C AND D STOCK SIZES

9.0" to 44.0" Pitch Diameter
3 to 10 Grooves inclusive

A TOTAL OF 451 SIZES

Patent applied for

THE SYMBOL THAT CAME TO LIFE

The man who walks into your factory wearing this symbol is the living embodiment of a service which gives you the correct answer to your problems in efficient mechanical transmission of power. He is the Dodge Transmissioneer.

The greatest device ever conceived for holding wheels to shafts is available to you in V-Belt sheaves in a *vast range of sizes.* For full details call your Dodge Transmissioneer, your local Dodge distributor. Look for his name under "Power Transmission Equipment" in your classified telephone directory. Ask for a demonstration of the Taperlock Sheave. See how **EASY** it is to mount and demount. Slip it on, line it up and tighten *while sighting.* No flange, no collar, no protruding parts. Yet it holds to the shaft with the firmness of a shrunk-on fit. It's new. It's different. It's another great development of Dodge Transmissioneering.

DODGE MANUFACTURING CORPORATION, MISHAWAKA, IND.

DODGE
MISHAWAKA

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Combination Thrust & Radial
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Radial, Single Row, Flanged
Radial, Single Row, Ground
Radial, Single Row, Precision
Radial, Single Row, Unground
Sheaves, Pressed Steel
Thrust, Ground
Thrust, Ground, Heavy Duty
Thrust, Light Duty
Thrust, Unground
Wheels, Pressed Steel

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BUSHINGS
Steel (For Hole Reduction)

CHAIN
Block
Ladder, Brass, Small Pitch
Ladder, High Tensile Steel, Small Pitch
Ladder, Steel, Small Pitch
Roller, Attachment, Standard
Roller, Double
Roller, Single, Non-Corrosive
Roller, Single
Stud, Small Pitch

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Setscrew, Standard Shafting

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Three-Jaw, Non-Metallic Cushion

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6 to 80 Diametral Pitch

GEARS, BEVEL
Brass, Small Pitch
Steel and Iron

GEARS, HELICAL
Bronze
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GEARS, INTERNAL
Brass, Small Pitch

GEARS, MITER
Brass, Small Pitch
Iron
Steel

GEARS, MITER, SPIRAL
Steel

GEARS, SPUR
Brass, Small Pitch
Brass, Sheet, Small Pitch
Change Gear Type
Fabroil
Non-Metallic
Pinions, Stem, Steel (5–10 Teeth)
Steel, Small Pitch
Steel and Iron
Steel and Iron (20° P.A.)

GEARS, WORM
Bronze, Single Thread
Bronze, Single Thread, Small Pitch
Bronze, Double Thread
Bronze, Double Thread, Small Pitch
Bronze, Four Thread
Bronze, Four Thread, Small Pitch
Iron, Single Thread
Iron, Double Thread
Iron, Four Thread

PILLOW BLOCKS
Ball Bearing, Flanged Cartridge Type
Ball Bearing, Self Aligning
Ball Bearing, Welded Steel
Cast Iron, Split
Cast Iron, Split, Oilite Bearing

PINION WIRE
Brass
Steel

PULLEYS
Brass, Grooved, Round Belt
Iron, Cone, Round & V-Belt
Iron, Grooved, Round Belt
Iron, Grooved, V-Belt
Steel & Iron, Crown Face, Flat Belt

RACK
Brass
Steel
Steel (20° P.A.)

RATIOMOTORS (MOTORIZED SPEED REDUCERS)
Horizontal Drives, 1/20 up to 3 HP
Vertical Drives, 1/20, 1/12, 1/4 & 1/3 HP

REDUCTORS (SPEED REDUCERS)
Horizontal Output Shaft Parallel Drives
Horizontal Output Shaft Right Angle Drives
Miter Gear Boxes
Vertical Output Shaft Drives

SHAFT SUPPORTS
Ball Bearing, Precision, Self Aligning
Oilite Bearing, Self Aligning

SPROCKETS
Block Chain, Steel and Iron
Ladder Chain, Bronze and Steel
Roller Chain, Double, Steel and Iron
Roller Chain, Single, Steel and Iron
Stud Chain, Brass

UNIVERSAL JOINTS
Steel, Bored
Steel, Unbored

WASHERS
Steel, Hardened, Thrust Type

WORMS
Steel, Single Thread
Steel, Single Thread, Small Pitch
Steel, Double Thread
Steel, Double Thread, Small Pitch
Steel, Four Thread
Steel, Four Thread, Small Pitch
Steel, Hardened and Ground
Steel, Unhardened

AVAILABLE NOW!

Write for your copy of Folder 1–46 on the new Nice 1600 Series "Inch-Size" Precision Radial Ball Bearings. Now available from stock for shaft sizes 3/16" to 1¼".

AVAILABLE SOON!

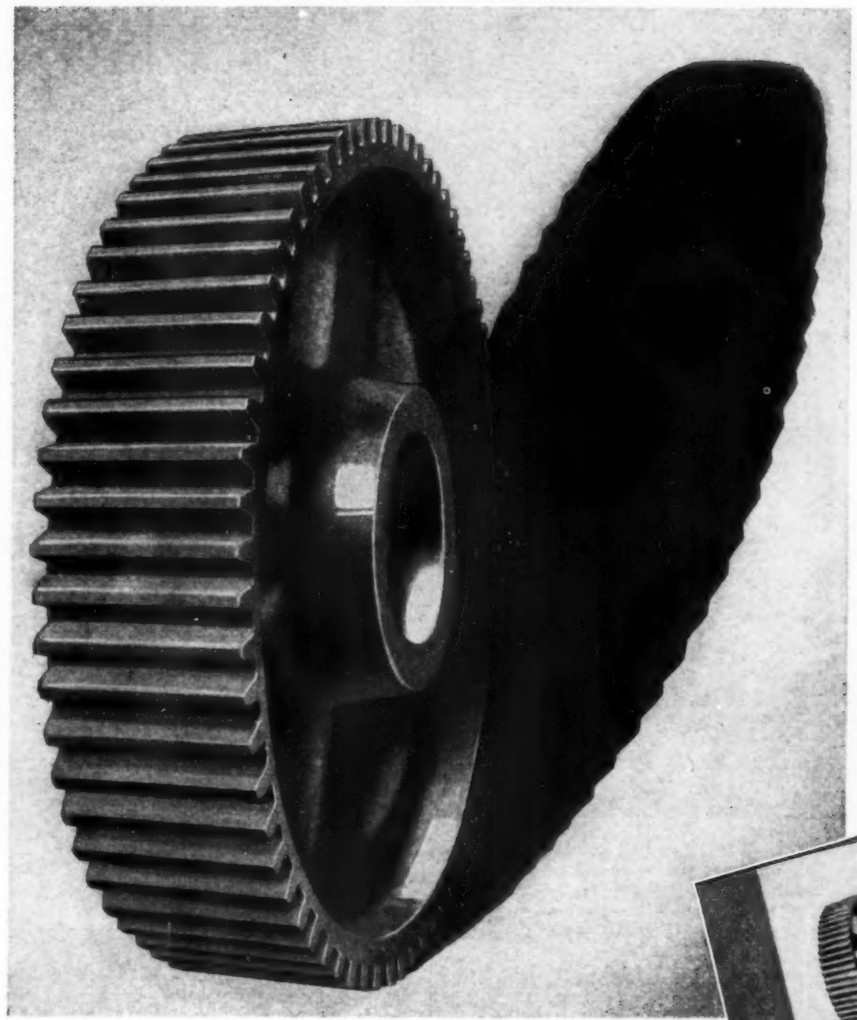
Our new General Catalog 54 is now being prepared and will contain complete specifications and list prices of the Complete Boston Gear Line. Shall we add your name to our mailing list to receive a copy of this valuable catalog?

THE BOSTON GEAR LINE IS STOCKED BY DISTRIBUTORS IN 63 CITIES FROM COAST TO COAST!

BOSTON GEAR WORKS, INC. NORTH QUINCY, MASSACHUSETTS

GEAR HEADQUARTERS

for over 54 years



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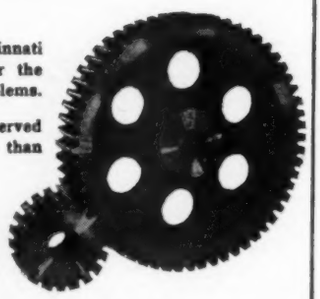

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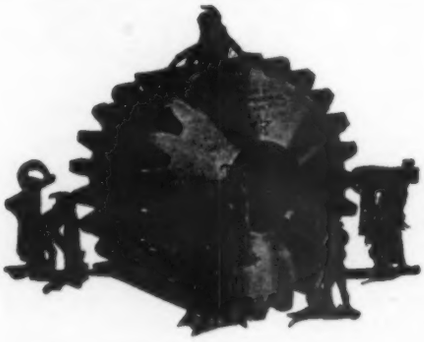

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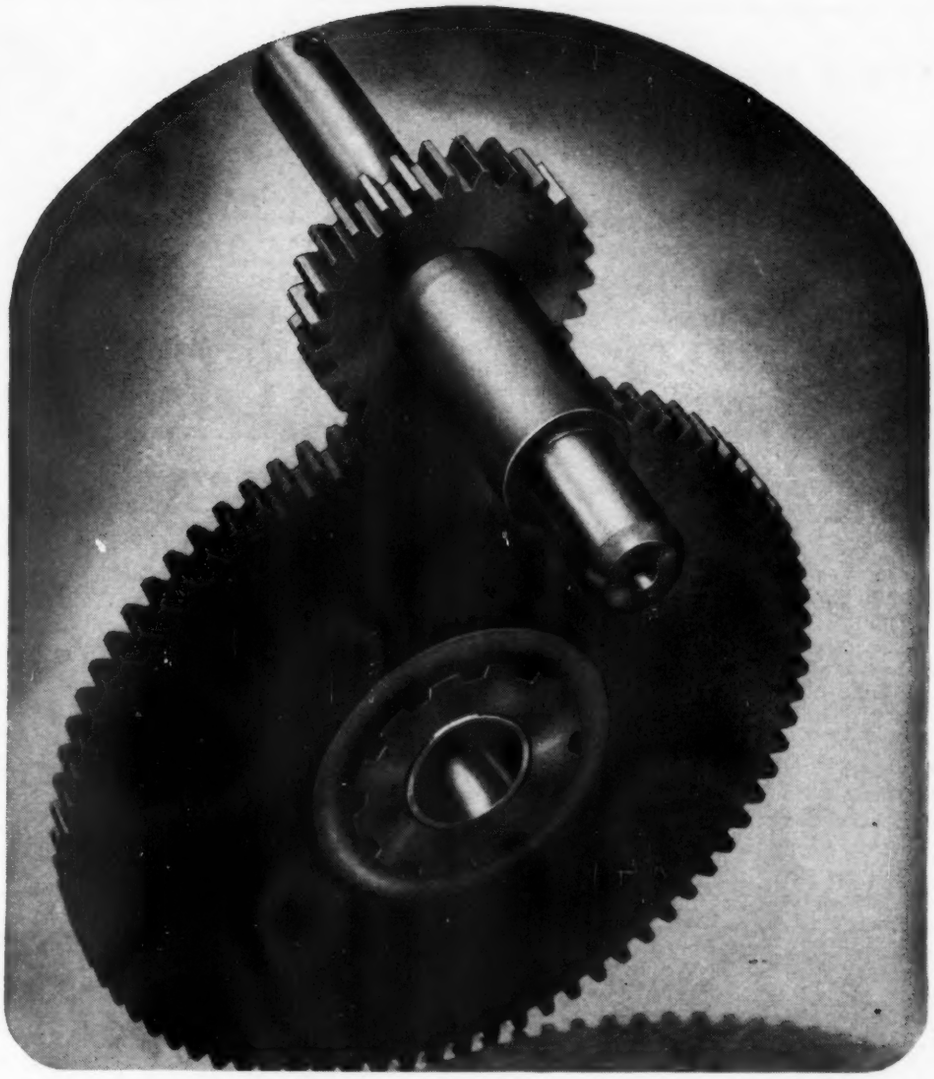

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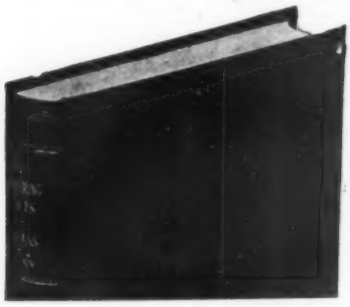

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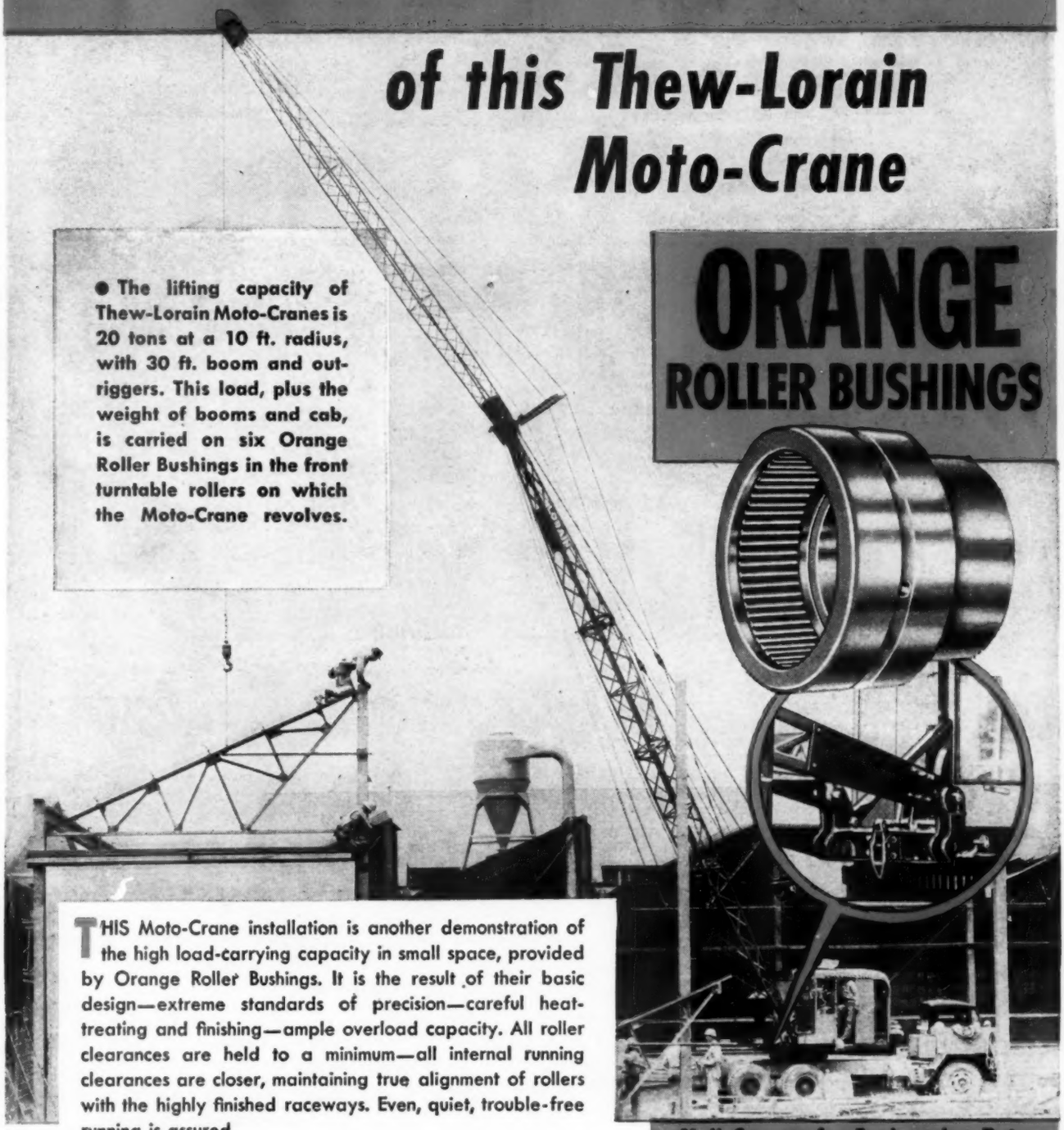

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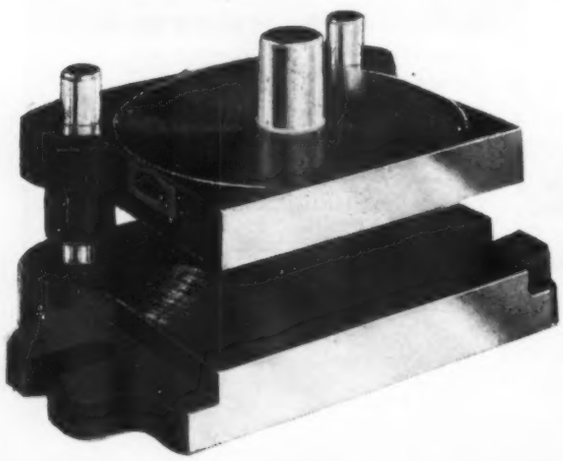

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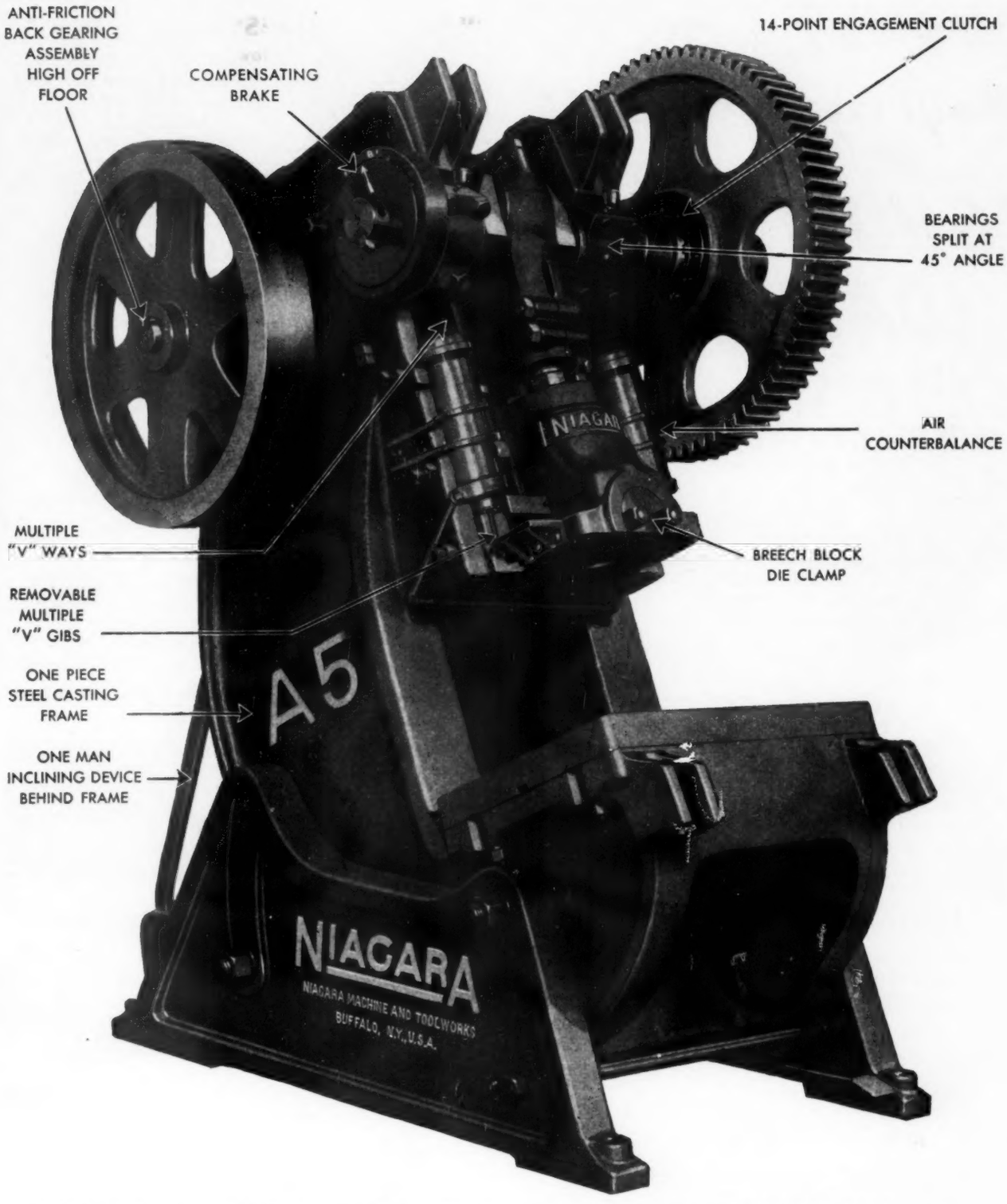

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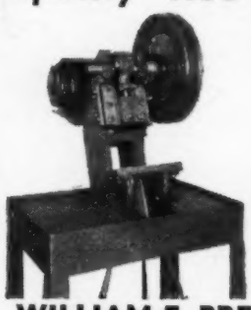

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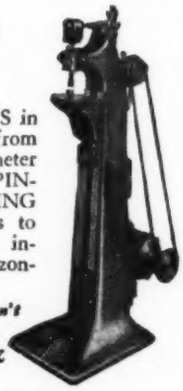

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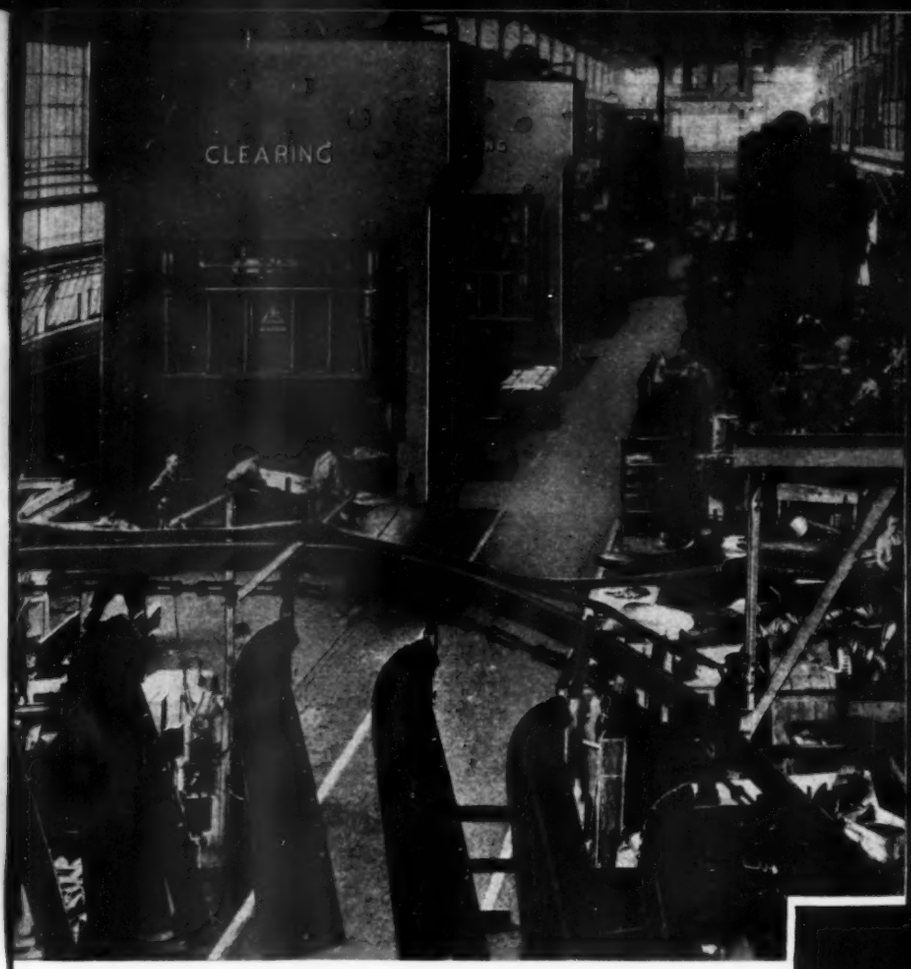

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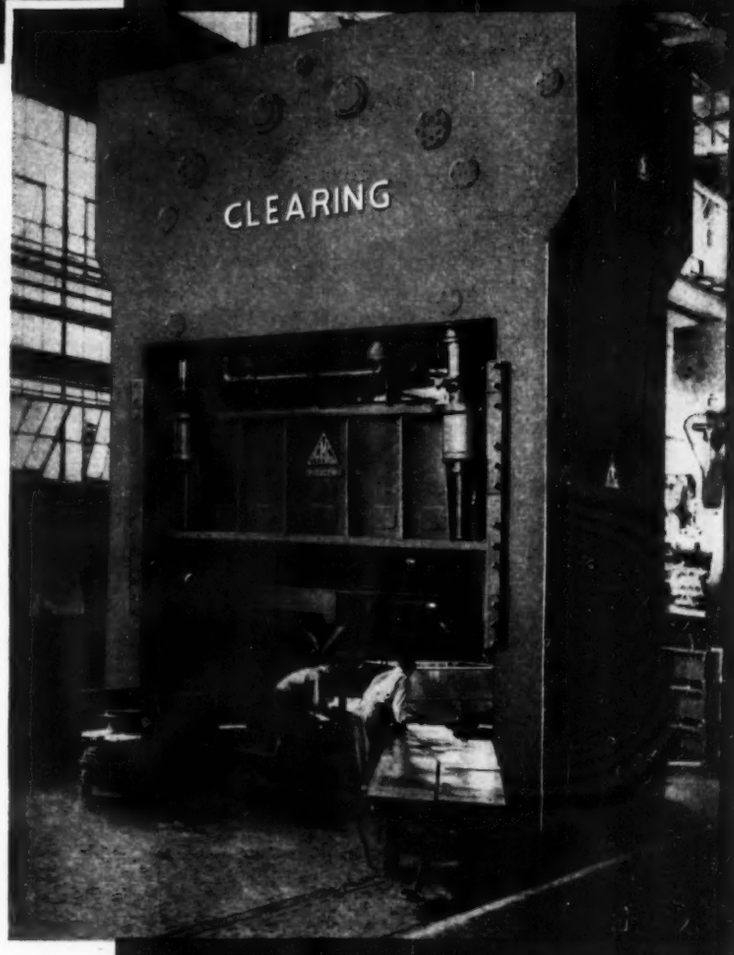
Clearing engineers will be happy to analyze your requirements in press equipment at any time. Clearing Presses, either mechanical or hydraulic, can be supplied in any size or type for every production demand.



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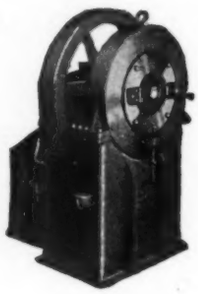

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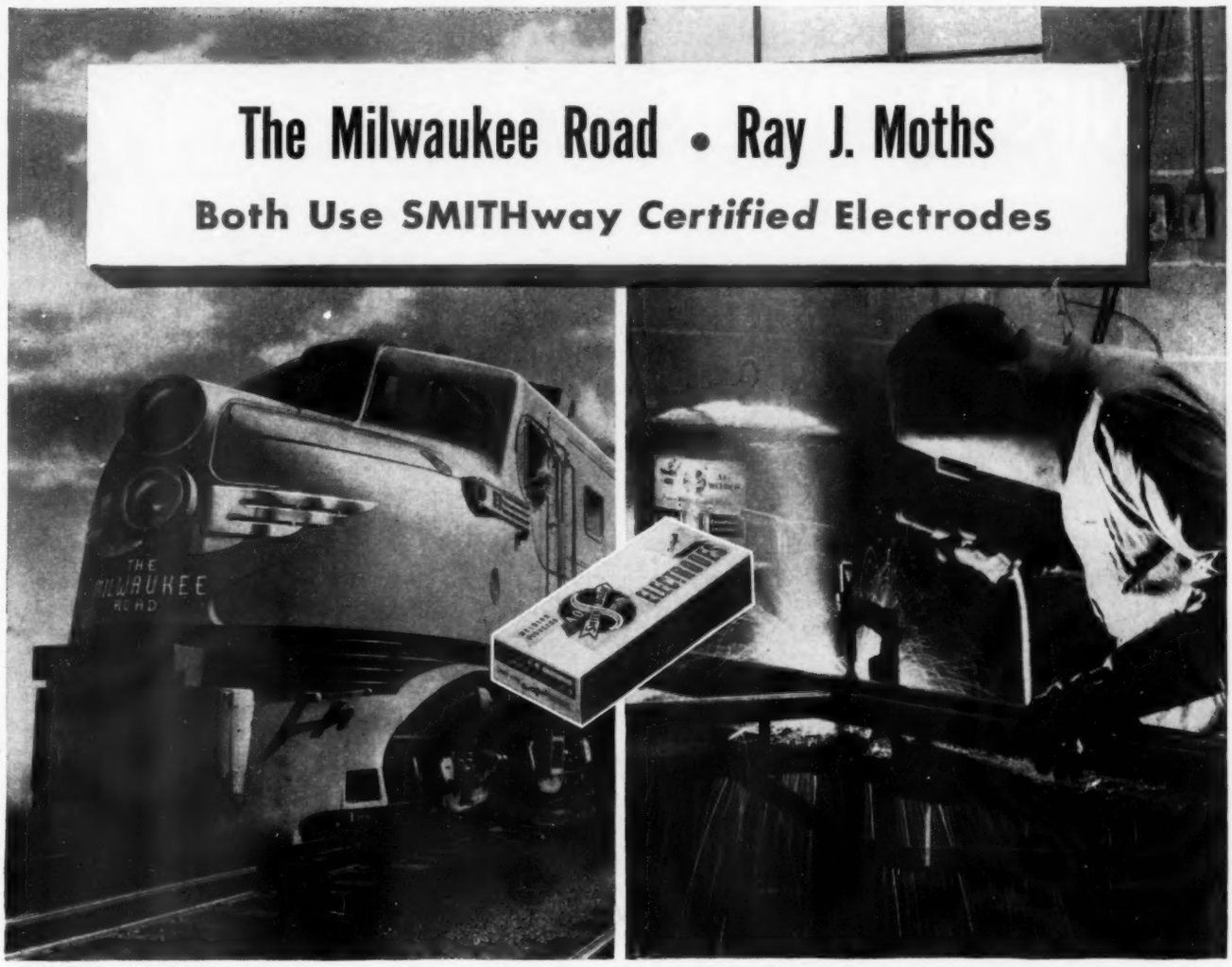

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● The operator of this traveling resistance-welder at the Pullman Standard Car Manufacturing Co., gets consistent welds automatically

Equipped with a G-E electronic current regulator and synchronous control, this resistance welding machine travels the length of the Pullman car producing uniform welds automatically. Each of these welds is of equal strength because the current regulator ***automatically compensates for varying line voltage and secondary circuit impedance.***

In welding these cars, two spot welds are made at a time, the spacing between the two varying in accordance with the dimensions of the parts and the strength specifications. As the spacing varies, the length of the secondary circuit changes, and in turn the current is changed.

Where formerly this shift meant frequent readjustments by the operator, guided by an extensive table of machine settings, now just one of two settings is needed, depending on whether the machine is welding Cor-Ten or stainless steel; the current regulator does the rest.

This regulator holds current within plus or minus 2 per-cent of normal, whereas, the unregulated current might vary as much as plus or minus 20 per-cent.

Even when space is uniform, current is affected by varying amount of magnetic material in current loop.

IMPROVES QUALITY

In this, and other applications such as welding propeller blades, metal barrels, etc., this regulator provides uniform quality welds when more or less metal is introduced in the welder throat.

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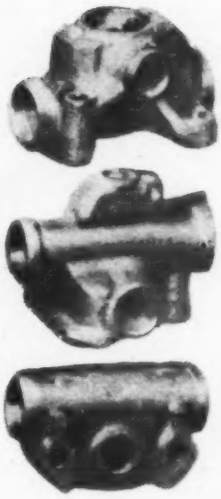
The same settings can be used when operating a press-type spot welder, a gun welder connected to the same transformer, or when welding magnetic materials with a press-or gun-type welder.

—The current regulator is specially designed for use with G-E electronic resistance welding controls which include heat control by the phase-shift method.

For additional information ask our nearest local office for Bulletin GEA-4220. *Apparatus Department, General Electric Company, Schenectady 5, N.Y.*

GENERAL ELECTRIC



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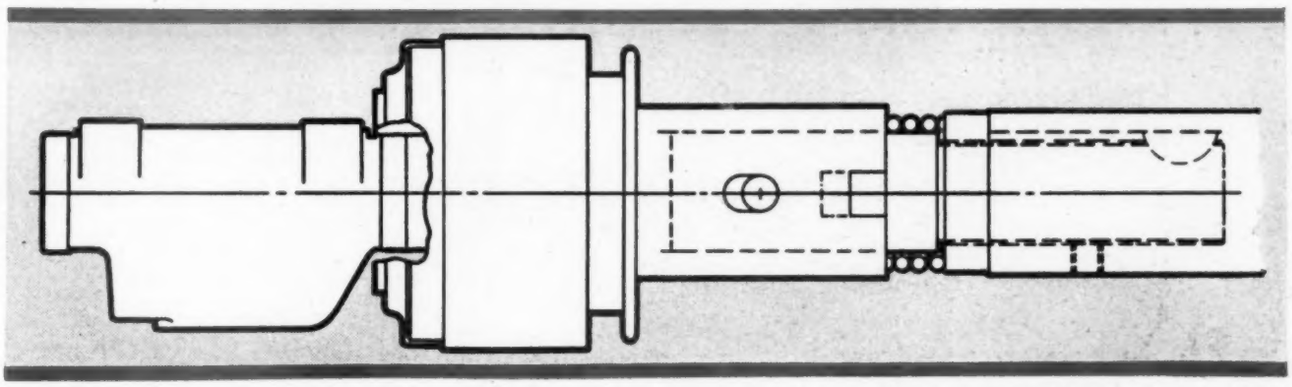
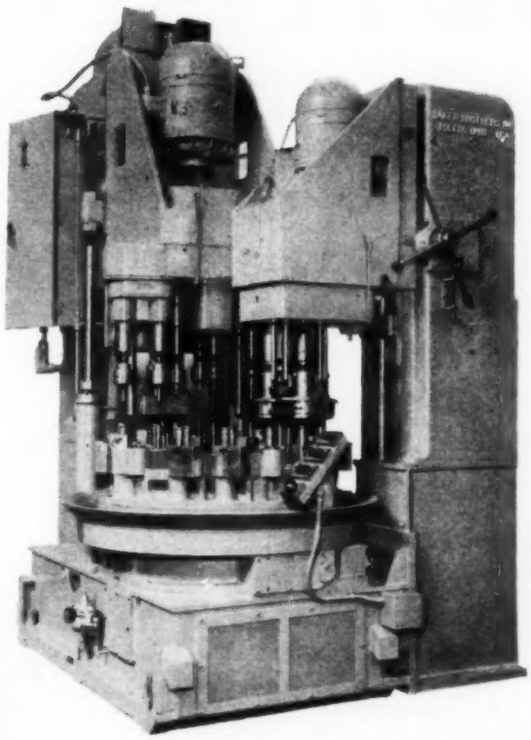


The Baker unit shown below ***Rough*** *Turns outside diameter and Rough Chamfers, Finish Turns outside diameter, Serrates, Finish Chamfers and Threads.*

● Baker's new Two Unit Vertical Multi-operation machine features a five-station automatic power index table, which permits loading and unloading at one station while the remaining four stations continue cutting. Parts are chucked over plugs in the main bores. The operator chucks two parts for operations on one end and re-chucks another two parts for work on the opposite ends, thus two parts are completed at each cycle. For operations at second, third and fourth cutting stations the machine is furnished with a vertical hydraulic feed multi-spindle unit. Over the fifth cutting station is mounted a four spindle vertical auxiliary threading unit. Each spindle of this unit carries a self-opening diehead for the threading operation. The two units are both automatic in cycle and are interlocked electrically.

As in all Baker machines, high productivity is emphasized in the design of this unit. Your production problems can be solved with equal effectiveness by Baker Engineers, regardless whether your operations involve drilling, tapping or boring.



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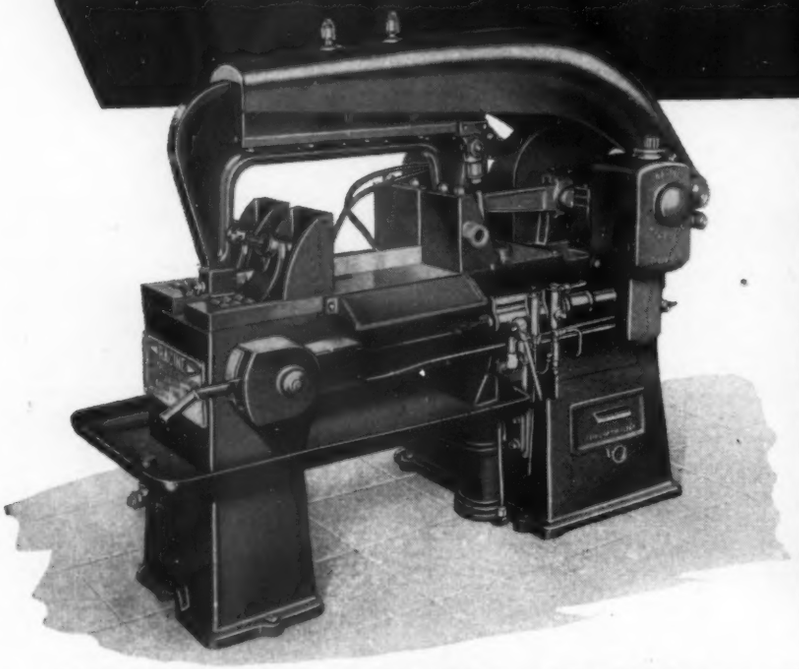
5 reasons why
YOU SHOULD USE RACINE MACHINES



1. **EASY OPERATION** — a single lever at the operator's fingertips controls all operating functions.
2. **OPEN FRONT** — quick, easy loading, special fixtures readily placed.
3. **CORRECT PRINCIPLE** — progressive feed throughout cutting stroke insures maximum depth of cut.
4. **EXTRA POWER** — hydraulic system more than adequate to handle any overload.
5. **ECONOMICAL OPERATION** — the few moving parts are extra heavy and rugged, no failures here.

FOR ALL YOUR METAL CUTTING WORK

Before you mill, drill, bore or grind a part made of metal, you must cut it off. Current, late model Racine Machines will "cut your cutting costs." All of them employ thin blades progressively applied. They are fast and accurate, save time and material.

Hydraulic feed and pressure provide a smooth, oil-cushioned cutting action. The blade cuts deep, taking out long, thin, curled chips. Power requirements are low. True faces reduce subsequent machining operations and eliminate waste of stock.

These modern machines are available in all capacities from 6" x 6" to 20" x 20". Automatic bar-feed models produce multiple pieces like an automatic screw machine.

Get all the facts on this equipment for your maintenance, tool room and production metal cutting. Racine engineers and field service men will cheerfully submit studied recommendations. Write today for the latest data. RACINE TOOL & MACHINE COMPANY, 1751 State Street, Racine, Wis.

RACINE OIL HYDRAULIC PUMPS AND VALVES

For power movements in machines in your plant or in any of your products, investigate RACINE HYDRAULIC equipment. Variable Volume Oil Hydraulic Pumps to 30 G.P.M. capacity. Pressures to 1000 p.s.i. Also a complete line of Hydraulic Valves in all sizes from ⅜" to 1½". Ask for Catalog P-10-C.

RACINE

STANDARD FOR QUALITY AND PRECISION

NEW...

GREATER PRECISION AND PRODUCTION FOR TOOL ROOMS!

No. 22 Horizontal Boring, Milling, Drilling and Tapping Machine . . . for tool room work, light production and adaptable for making plastic molds.

- ★ Positive infinitely variable high speeds from 25 to 1600 R. P. M. in either direction directly on the main spindle giving complete range of speeds in one spindle.
- ★ 18 feeds in geometric progression, ranging from .002 to .125 per revolution of spindle. Five feeds are standard tapping leads.
- ★ Direct reading indicator for feeds and spindle speeds.
- ★ Speed and feed mechanism, and spindle housing are of unit construction.
- ★ Fast travel to all units.
- ★ Spindle and feed units run in bath of oil.
- ★ Column ways are extra wide . . . 5″ x 1½″ and 18″ across. Bed ways are 5″ x 1½″ and 24″ across. Table ways are 4″ x 1½″ and 22″ across.
- ★ Complete oversize construction to insure rigidity, strength and accuracy.
- ★ Extremely long saddle ways to support table.
- ★ 24″ x 36″ table has working surface of its entire area with "T" slots and cross slots.

Write for bulletin.
Defiance MachineWorks, Inc.,
Defiance, Ohio.

DEFIANCE

95 YEARS OF PRECISION MANUFACTURING

Bridgeport

TURRET MILLING MACHINE

More work at lower cost with less operator effort is assured by the "BRIDGEPORT" and proved in everyday operation in many shops. Furthermore, the Bridgeport Turret Milling Machine can be depended on for high, maintained standards of accuracy on long production runs. It provides the answer for many shops which are striving for lower piece costs because it is inherently a cost-cutting machine in that it will mill, drill, bore and shape at all angles of the work without changing set-up. *Full information on the "Bridgeport" is available promptly on request.*

SPECIFICATIONS

Longitudinal Feed	20"
Cross Feed	9"
Vertical Feed of Knee	16"
Standard Table	9" x 32"

Special Tables up to 48" available; also longitudinal power feed

Weight with Shaping Unit—2000 lbs.

THE *Bridgeport* MACHINES, Inc.
Bridgeport, Conn.

Newest

CONTRIBUTION TO HIGH PRECISION IN METAL WORKING!

No. 3K SIP JIG BORER

On the new SIP No. 3K Jig Borer, direct readings can be made to 0.00005 inches—without using separate instruments! All settings are made with built-in measuring devices. Table, spindle saddle and cross-rail are rigidly mounted to preserve perpendicularity, so that accuracy to 0.0002 inches can be maintained over the complete range of operations.

New Large table working surface 20½ x 15 inches . . . powerful spindle speeds from 75 to 2000 R.P.M. . . . six automatic table feeds in either direction . . . make the 3K Jig Borer capable of rapid machining over a wide range. For machining very small holes, it can be equipped with a guiding arm holding interchangeable bushes and carried on a scraped prismatic surface on the lower part of the spindle head. When equipped with the SIP tilting rotary table, any combination of rectangular and polar coordinates can be laid out rapidly and accurately.

SIP JIG BORERS RANGE OF TABLE SIZES

Write for full details of the New 3K and other SIP Jig Borers in the following range of table sizes.

No. 2C	18" x10¾"
No. 3K (illustrated)	20½"x15"
No. 4G	27½"x23⅝"
Hydroptic-B	39½"x32"
No. 5G	43⅜"x32"

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

NOW... all the well-known Delta-Milwaukee operating advantages in a low-cost drill press with a speed range up to 12,000 R. P. M.

DELTA
MILWAUKEE
REG. U. S. PAT. OFF.

Super-Hi*-Speed Drill Press

Greater accuracy on small-hole drilling of plastics, aluminum, and other metals

Here's a sensitive, low-cost 14" drill press for small-hole work from .025" to ¼" diameter. Drills to center of 14" circle.

Three-step pulley permits speed range of 12,000 . . . 8000 . . . 5000 R.P.M. Dynamically-balanced motor. Full spindle travel of 2¼". Specially-selected Jacobs chuck.

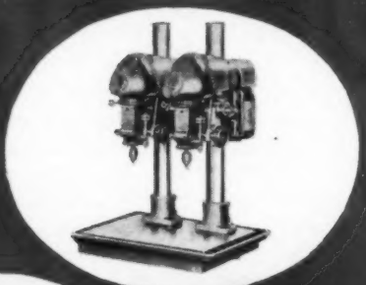
Famous Delta-Milwaukee construction features include:

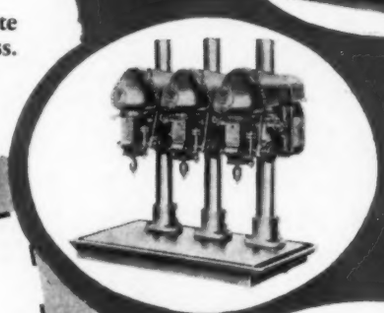
- **Lubricated-for-life ball bearings, double-sealed against harmful abrasive dust.**
- **Pre-loaded ball bearings.**
- **Precision-ground spindles.**
- **Dynamically-balanced pulleys.**

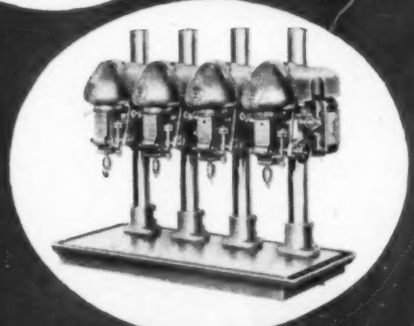
Single-spindle model, with production table. 2-spindle, 3-spindle, and 4-spindle models, with sectional tables. Head, complete with motor, available separately for use on your present 14" drill press columns.

See your Delta industrial distributor for the complete story on the Delta-Milwaukee Super-Hi-Speed Drill Press.

Send coupon for Bulletin No. A-14-3.







ROCKWELL DELTA

Subsidiary of Rockwell Manufacturing Co.

Tear out coupon and mail today!

THE DELTA MANUFACTURING CO.
609H E. Vienna Ave., Milwaukee 1, Wis.

Please send me a free copy of the Delta-Milwaukee Super-Hi-Speed Drill Press Bulletin No. A-14-3.

Name.....Position.....
Company.....
Address.....
City.....( ) State.....

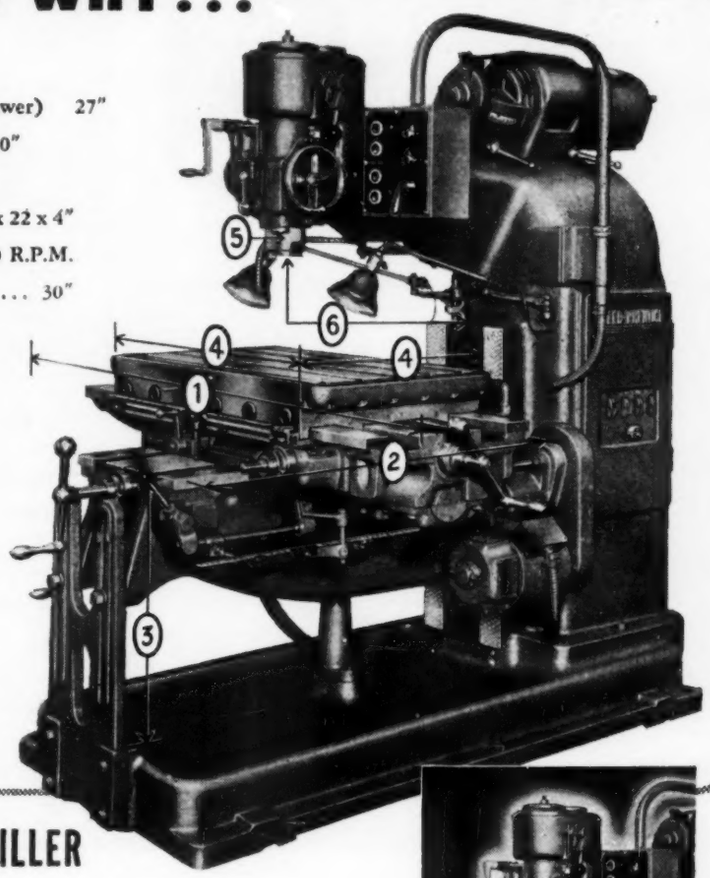
M-18

*Trade Mark Reg. U. S. Pat. Off.

8 REASONS WHY...

1. Longitudinal feed (hand or "electronic" power) 27"
2. Cross feed (hand or "electronic" power) 20"
3. Vertical feed of knee (hand) .. 16"
4. Table: Length by width by thickness 32 x 22 x 4"
5. Spindle speeds (infinitely variable) 90-2200 R.P.M.
6. Throat depth, with ram fully extended ..... 30"
7. Universal head swivels 45 degrees front and back of vertical.
8. Universal head swivels 30 degrees left or right of vertical.

Horizontal ram adjustment (hand) 16"
Vertical travel of spindle ..... 5"
Taper hole in spindle NMTBA #40
Electronic power cross or longitudinal feeds ..... ½"-40" per min.
Weight — with power feed 6,750 lbs.

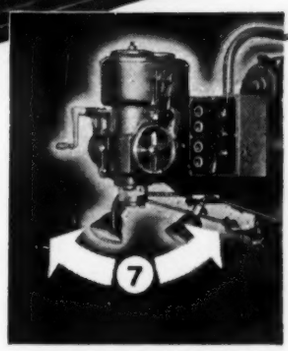


The 22-V UNIVERSAL HEAD VERTICAL MILLER and DIE SINKER

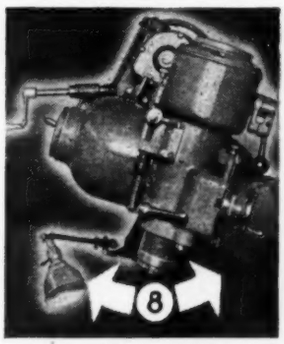
. . . will give you greater RANGE!

Here are PLUS values! The Reed-Prentice 22-V has EXTRA efficiency . . . is adapted to an exceptionally wide range of work! Quicker too — because the combination of the universal head and the infinitely variable feeds and spindle speeds permit milling, drilling and boring operations with only one set-up!

These features save time and cut costs. The machining of plastic and rubber molds, die casting dies, forge dies, or jigs and fixtures is faster with the adjustable swivel head, electronically controlled cross and longitudinal power feeds and attachments available for high speed milling and slotting. For extra utility in the toolroom — investigate the 22-V NOW! Write for complete information to Dept. A.



Universal head swivels 45° front and back of vertical.



Universal head swivels 30° left and right of vertical.

MACHINE TOOLS

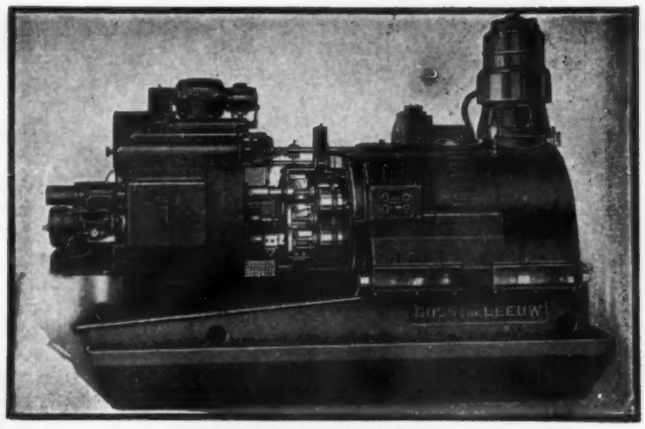
REED-PRENTICE CORP.

WORCESTER MASS., U.S.A.

NEW YORK OFFICE:
75 West St., New York 6, N. Y.

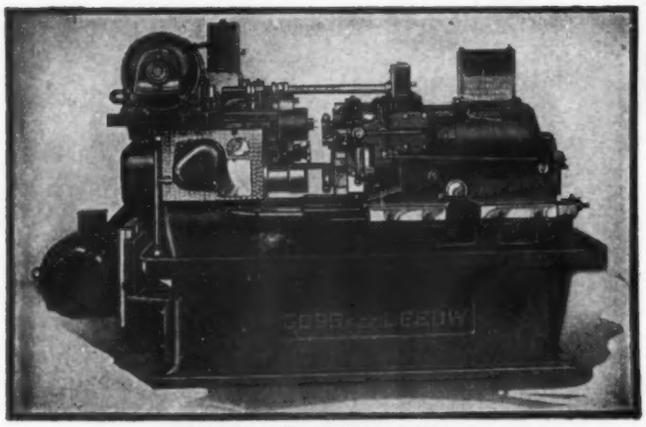
CLEVELAND OFFICE:
1213 W. 3rd St., Cleveland 13, Ohio.

GOSS & DE LEEUW
Multiple Spindle
CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

MOREY *Universal* TURRET LATHES
for BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

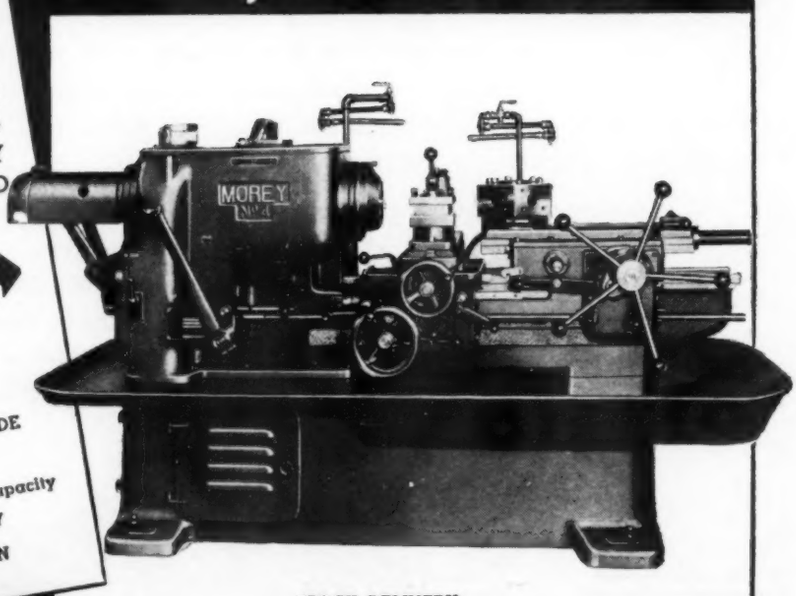
EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM.
constant speed motor, 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal, 1½" capacity
No. 2 Plain, 1" capacity

ASK FOR DESCRIPTIVE BULLETIN



STOCK DELIVERY

DESIGNED AND BUILT BY
MOREY MACHINERY CO., INC 410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK

FLEXIBILITY

A BIG WORD IN PRODUCTION MANAGEMENT

DRILL PRESSES

RADIAL DRILLS

RADIAL CUT-OFFS

BAND SAWS

GRINDERS

New products should mean new tools—the plant equipped with modern, flexible, highly efficient machine tools will have the jump on manufacturers using equipment and methods that are obsolescent.

At relatively small cost almost any plant can improve its manufacturing processes **and keep those processes flexible** by re-tooling with Walker-Turner light Machine Tools.

Flexibility is ensured—not only because each unit costs little and can be moved, set aside or even scrapped when its work is done, without financial hardship—but because each machine has a wide range of performance in speeds, spindle travel and size of work accommodated with full visibility and efficient operation. A Walker-Turner equipped shop can change its production set-up over a weekend at little or no cost.

And it won't be a compromise, for these machines were operated on 24 hour-day schedules throughout the war years. They are now being ordered in thousands of plants for in-the-line production wherever metals, wood and plastics are drilled, cut or shaped.

Management is realizing that its past "investment" in machine tools which have become obsolete can be profitably written off with replacements of light, highly productive Walker-Turner Machine Tools. A complete catalog will be sent on request.

SOLD ONLY BY AUTHORIZED INDUSTRIAL MACHINERY DISTRIBUTORS

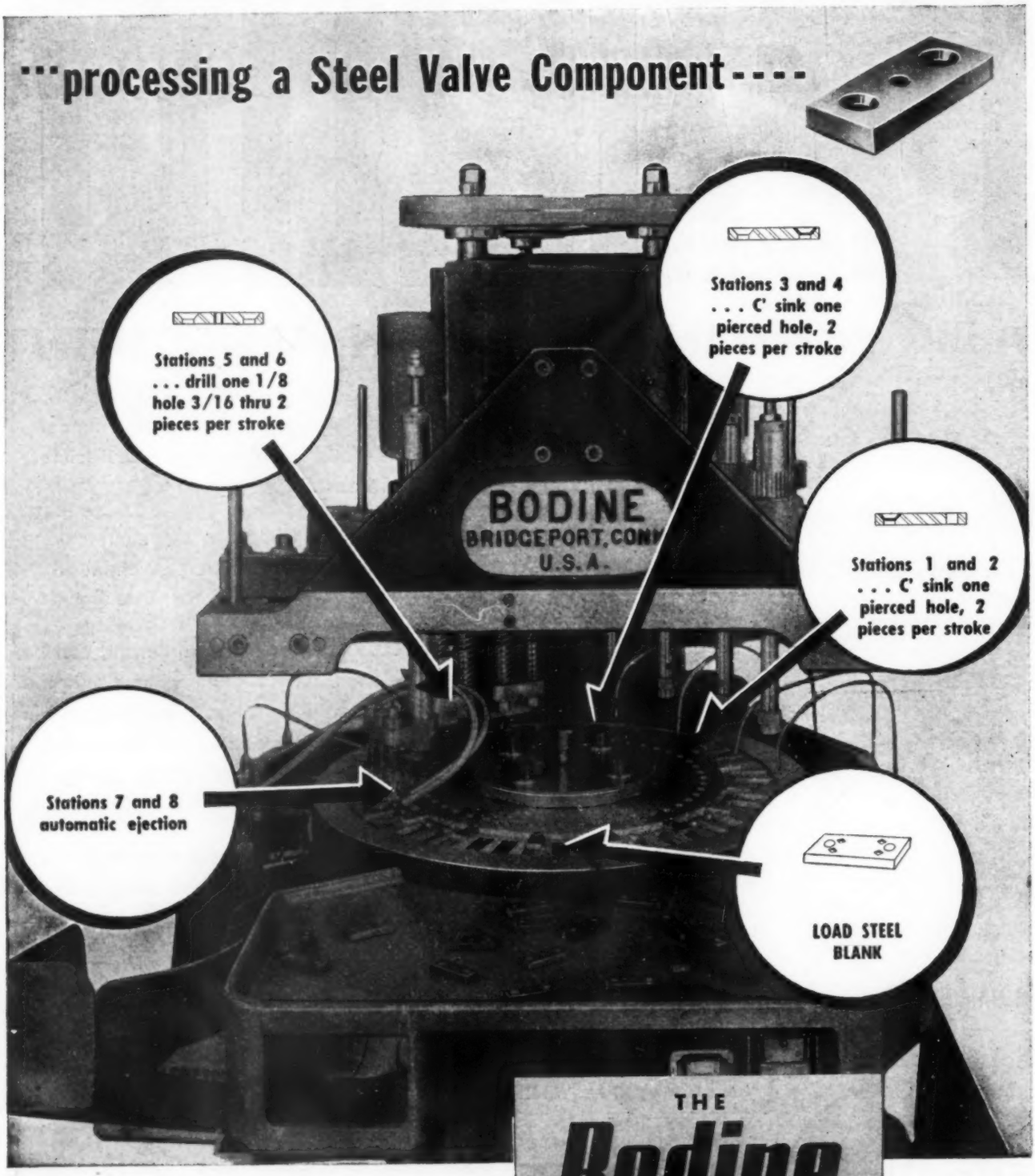
walker-Turner
COMPANY, Inc.
PLAINFIELD, N.J.
U.S.A.

MACHINE TOOLS

DRILL PRESSES—HAND AND POWER FEED • RADIAL DRILLS • RADIAL SAWS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

Bodine..Case History No. 17

...processing a Steel Valve Component----


Stations 5 and 6 . . . drill one 1/8 hole 3/16 thru 2 pieces per stroke
Stations 3 and 4 . . . C' sink one pierced hole, 2 pieces per stroke
Stations 1 and 2 . . . C' sink one pierced hole, 2 pieces per stroke
Stations 7 and 8 automatic ejection
LOAD STEEL BLANK
BODINE
BRIDGEPORT, CONN.
U.S.A.

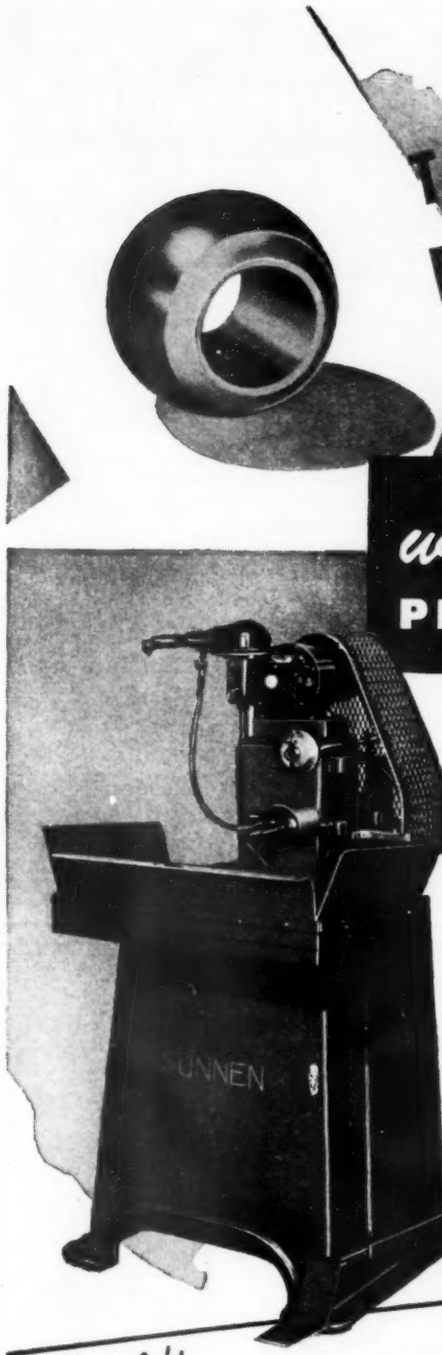
• Production 1800 pieces per 50 minute hour...2 pieces per stroke on this Bodine 6 spindle Drilling Machine. Bulletin on request.

THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT
AUTOMATIC RADIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

TOLERANCE, .0002" FINISH, 10 MICRO INCHES

On Bearing Races at National Sewing Machine Co.

with the SUNNEN PRECISION HONING MACHINE



That is the performance of the Sunnen Precision Hone on a production basis, honing bearing races for aircraft bearings. These races are heat treated steel with a C scale Rockwell of 60-62.

The versatility of the Sunnen Precision Hone is demonstrated in this plant, where jobs ranging from an inside diameter of .1895" to 2" are handled. Even on the larger pieces, tolerances are never over .0005".

This is another example of the many hundreds of uses for the Sunnen Precision Hone on both war and peace-time jobs where accuracy and smooth finish are important. This machine will accurately hone any internal diameter from .185" to 2.625" with a guaranteed accuracy of .0001". Holes are straight and true and can be given a finish that is exceptionally smooth — often 2 to 3 micro inches. This means longer life of parts, fewer rejects, and greater interchangeability of parts.

It does not require skilled labor, no jigs or fixtures are needed, can be set up in one to two minutes, is economical to operate.

Why not find out how the Sunnen Precision Hone can be used in your plant? A Sunnen engineer will be glad to show you how it can help you get greater accuracy and smoother finish in less time — or write for free bulletin giving complete details.

Typical Jobs

Automobile Distributor Shaft Gears Taper removed at a rate of 80-90 per hour.

Aircraft Valve Guide. Valve tappet roller pin hole honed to 6 micro inch finish.

Roller Bearing Outer Race. Finish improved from 12 micro inches to 2 micro inches.

Compressor Yoke. Alignment maintained and better finish produced.

Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping — and gave a straighter hole.

SUNNEN

SUNNEN PRODUCTS COMPANY, 7941 Manchester Ave., St. Louis 17, Mo.

Canadian Factory: Chatham, Ontario

SPEED IN COLD METAL SAWING

The PORTER - McLEOD IS DESIGNED FOR HIGH SPEED COLD METAL SAWING

Straight, clean cuts on a truly high production basis are assured by the 8" Porter-McLeod. It is a compact, sturdy, amply powered unit designed for handling general or production work with utmost operating convenience and control. Economical quantities of bars or shapes can be "nested" and held rigidly during cutting by means of supports provided on sides and bottom combined with clamping pressure at top.

In the Porter-McLeod, the blade is supported for accurate cutting and for protection against damage. Adjustment is also provided for changes in blade thickness. Feed of blade is upward to stock with provision made to prevent weaving and buckling. Standard feeds up to 3" per minute are available. Protection against blade breakage due to hard spots in stock is provided by a friction feed disc.

This machine will handle either 8" round or 7½" square stock or the equivalent in "nested" work.

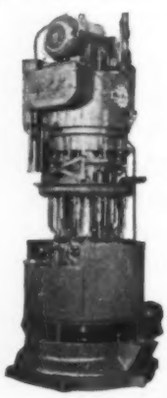
Investigate the high production possibilities of this machine by sending for descriptive Bulletin.

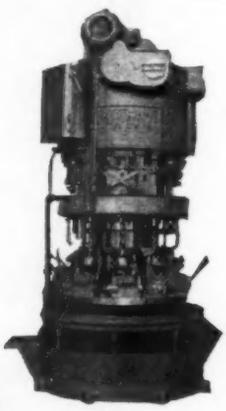
MACHINE TOOL COMPANY

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASSACHUSETTS, U.S.A.

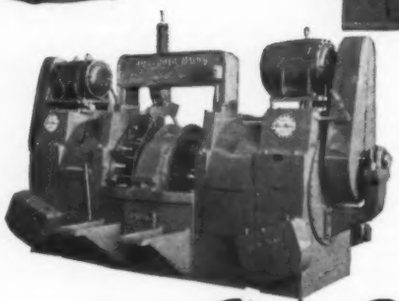
Roto-Matic Drilling MACHINES

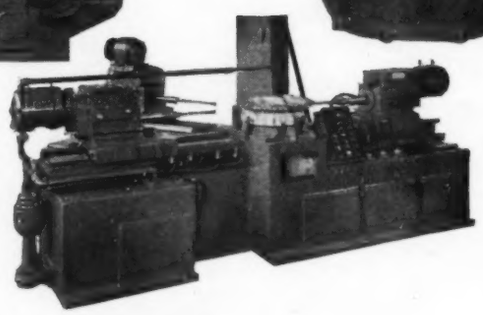
VERTICAL AND HORIZONTAL TYPES





MULTIPLE SPINDLES





Highest Production — Low Maintenance

MILLING • DRILLING • REAMING • BORING • PIPE THREADING • SPECIAL MACHINES

DAVIS & THOMPSON COMPANY
MANUFACTURERS: MACHINE TOOLS, MICROMETERS AND GAGES
MILWAUKEE WISCONSIN

You get better, more tenacious adhesion of Organic Finishes on ALUMINUM when surfaces are conditioned with

Oakite Compound No. 36

Products fabricated from aluminum and its alloys and to which organic finishes are applied for decorative or protective purposes, require special surface treatment if firm, tenacious grippage of paint, enamel or lacquer is desired. Rejects and poor quality work frequently result when proper surface preparation is omitted.

There are many methods for handling this work. A few are more effective and economical than others. One of these is the Oakite method involving a simple chemical treatment with Oakite Compound No. 36. A mildly acidic liquid material, Oakite Compound No. 36 microscopically etches surfaces and then forms a thin, inert, adherent film of aluminum phospate, which not only retards corrosion but, at the same time, provides a surface and base for the tenacious grippage of organic finishes.

Three Ways to Apply Oakite Compound No. 36

After pre-cleaning Oakite Compound No. 36 may be applied by automatic washing machine, dip tank method or by hand wiping technique. Method depends on size and shape of aluminum parts; production volume and equipment available.

Free Data Gives You Method Details

Any plant applying paint finishes to aluminum should send for free Special Service Report giving details of this plant-proved Oakite method for successfully conditioning aluminum. Please make request on your company letterhead. All inquiries promptly answered.

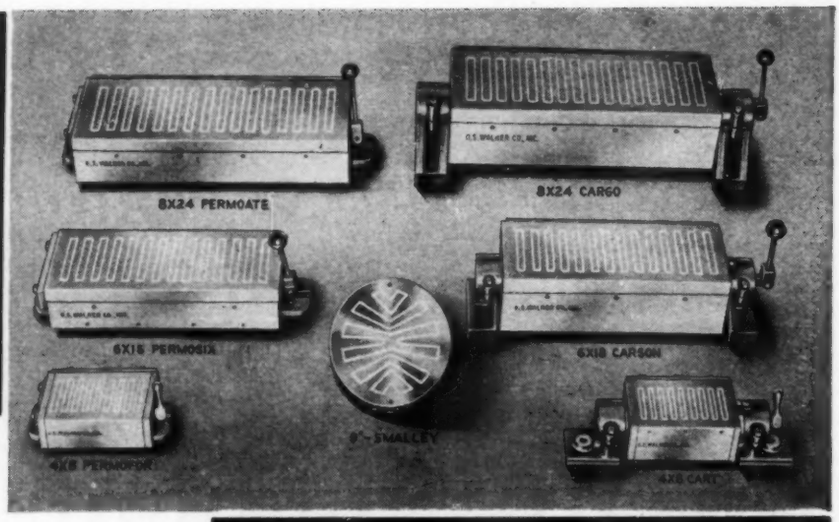
Oakite Products, Inc., 24 Thames Street, New York 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**

MATERIALS · METHODS · SERVICE

Walker Chucks



Truly a credit to the O. S. Walker Co., Inc.

Over 60 years of chuck building, design, and engineering experience is incorporated into these PERMOS.

WALKER ENGINEERS invite you to present your problems for solution at no obligation.

REMEMBER there is a WALKER CHUCK for every known application.

O. S. WALKER CO., INC.

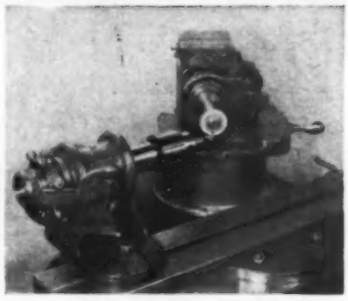
Original Designers and Builders of Magnetic Chucks

Worcester 6, Mass.

This is the WALKER PERMANENT CHUCK FAMILY

Axial Relief

GRINDING FIXTURE



Set-up for flute grinding

One Fixture Does the Work of SEVERAL

No longer is it necessary to invest in a different grinding fixture for each individual grinding job. The Axial Relief Grinding Fixture does away with this needless expense by enabling you to grind cutting edges, steps, flutes and chip relief—all with a single fixture.

Just the thing for grinding milling cutters, burring tools, counterbores, countersinks, end mills, reamers, drills and taps. Can be used on both surface grinders and cutter grinders.

Send for literature explaining simplicity of operation and illustrating typical applications.

WRITE FOR Literature

GOVRO-NELSON CO.

1933 Antoinette Detroit 8, Mich.

ANTON PARALLELS

INCREASE PRODUCTION IMPROVE QUALITY USE ANTON PARALLELS

ANTON PARALLELS FILL A LONG-FELT NEED—Permanently straight and accurate, yet priced for general machine shop use. All parallels fully guaranteed to be within the limits specified. Maximum size tolerance .001 inch on ground sides. Maximum variation in parallelism and straightness within length, .0001. Rockwell "C" hardness 65 up.

ANTON PARALLELS COME IN THREE STANDARD SIZES—

- ¼" Thick x 6" Long—½" to 1-13/16" High in Steps of 1/16" $85.00 per set—22 pairs.
- ½" Thick x 6" Long—1-3/16" to 1-13/16" High in Steps of 1/16" $71.00 per set—11 pairs. $106.00 per set of 11—3 each size.
- ¾" Thick x 6" Long—1-3/16" to 1-13/16" High in Steps of 1/16" $88.75 per set—11 pairs.

Price per set includes a large Wooden Container. Large Stock of Single Pairs also Available. All Prices are F.O.B. New York

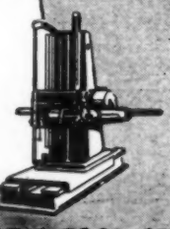
ANTON MACHINE WORKS

52 Sands St. Tel. TR. 5-8092 Brooklyn 1, N. Y.

DEALERS: Morris Abrams, 196 Centre St., New York 13, N. Y.; Arrow Machine Tool Co., Inc., 251 Richmond St., Providence, R. I.; Charles R. Yerger & Co., 7800 Bayard Road, Philadelphia 19, Pa. Hansen & Hasle, 135 Myrtle Ave., Brooklyn 1, N. Y.

GILBERT

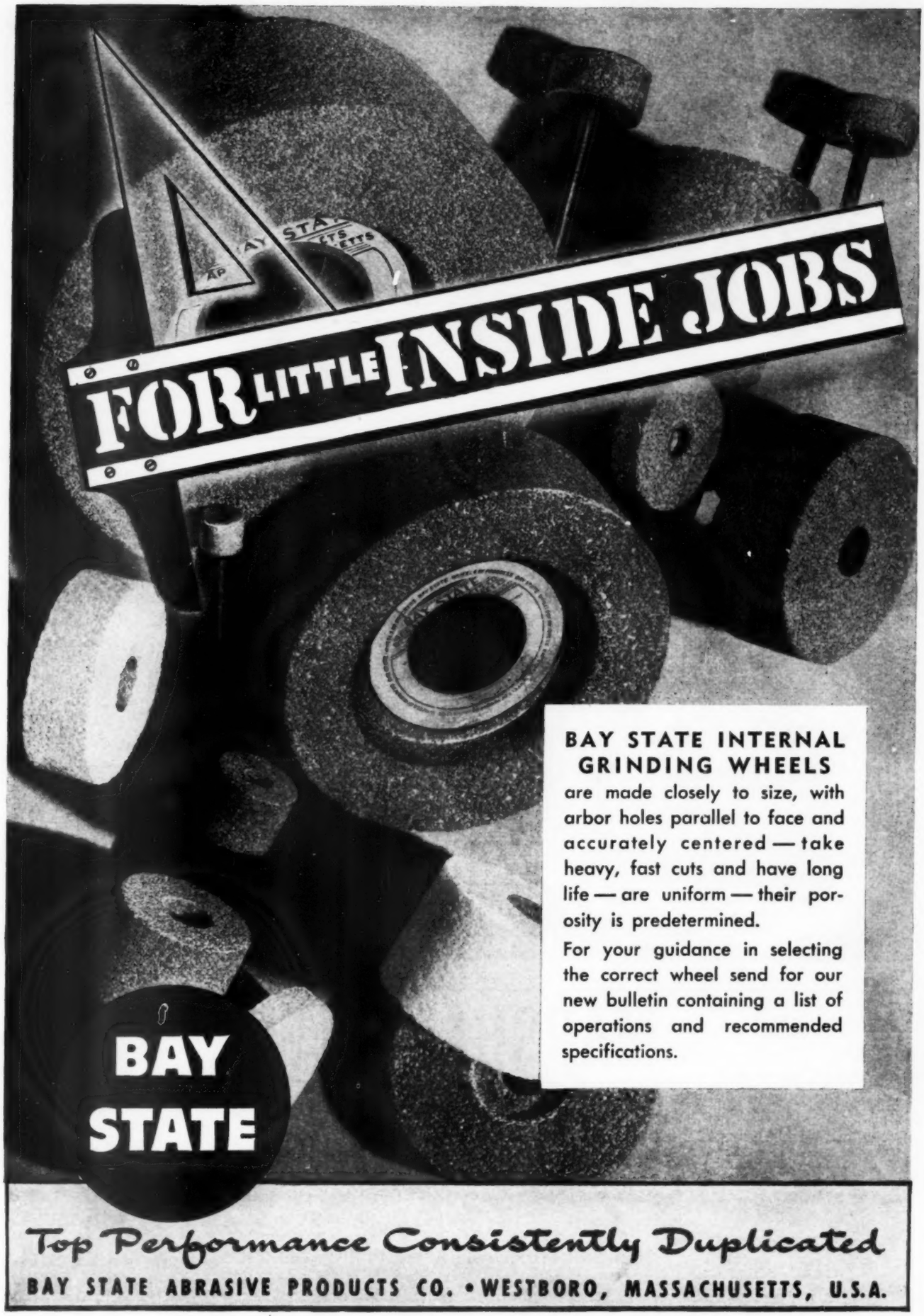
PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



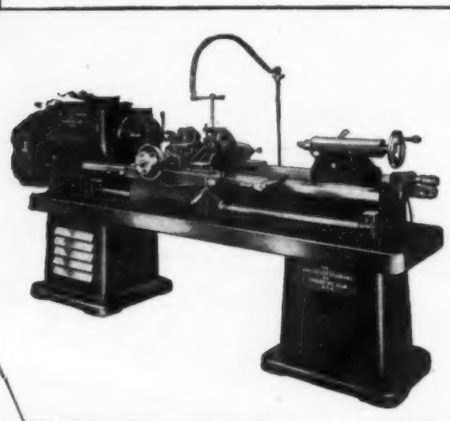
DETAILS ON REQUEST

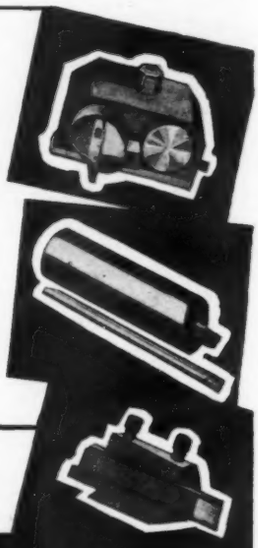
THE CINCINNATI GILBERT MACHINE TOOL CO.

CINCINNATI, OHIO


FOR LITTLE INSIDE JOBS
BAY STATE INTERNAL GRINDING WHEELS
are made closely to size, with arbor holes parallel to face and accurately centered — take heavy, fast cuts and have long life — are uniform — their porosity is predetermined.
For your guidance in selecting the correct wheel send for our new bulletin containing a list of operations and recommended specifications.
BAY STATE
Top Performance Consistently Duplicated
BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.

40 YEARS OF EXPERIENCE produced
THE NEW COULTER
AUTOMATIC THREADING LATHE



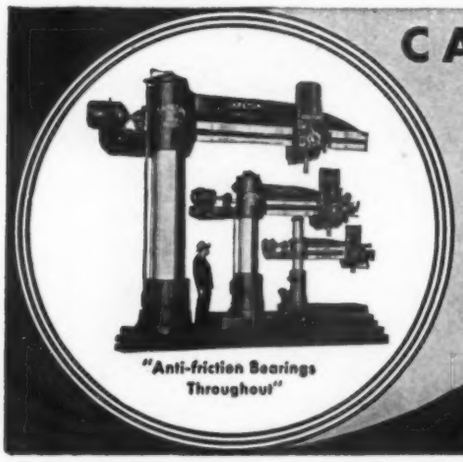


The many different and number of threading tools which can be arranged on the tool slides both front and rear, make this machine the most versatile of any for production of square, standard, and 29 degree threads, both internal and external.

Equipped with disc clutch. . . . Easy to operate. . . . Rigid Construction. . . . Four speed headstock. . . . Return or Idle travel speed has been increased five times cutting speed.

PRODUCTION MACHINES SINCE 1896
Write for full particulars

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.



"Anti-friction Bearings Throughout"

CARLTON RADIAL DRILL

FEATURES— 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The
CARLTON
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U.S.A.

★
SAVES TIME
MAKES MONEY
★
CUTS ANY SHAPE
CUTS ANY SIZE
★
CAPACITY UP TO
1/4" STOCK

MARSHALLTOWN
THROATLESS SHEARS

Here's the shear that offers best performance features. Cutting speed 6' per minute. High grade tool steel cutters. Write today for details. Prompt shipment.

MARSHALLTOWN MANUFACTURING COMPANY
910 Nevada Street Marshalltown, Iowa

New light-colored, odorless S/V Sultran Oils

proved superior in precision cutting!

Get this Complete Lubrication Program for all your machines

- Lubrication Study of Your Entire Plant
- Recommendations to Improve Lubrication
- Lubrication Schedules and Controls
- Skilled Engineering Counsel
- Progress Reports of Benefits Obtained

GARGOYLE Lubricants

Shop operators report improved finish, longer tool life, better working conditions.

SINCE their introduction a few months ago, Socony-Vacuum's new transparent, light-colored, odorless S/V Sultran Oils have established entirely new standards for cutting oil performance.

The picture above shows typical examples. These parts for precision instruments were cut to remarkably close tolerances. Analysis of results showed finer finish, fewer rejects, longer tool life, and consequent savings.

Other reports: "Tool life doubled in drilling, reaming and tapping." "Production increased 25%, drilling stainless steels." "Carry-off reduced 60% in threading operation." "Higher speeds made possible because of greater cooling effect."

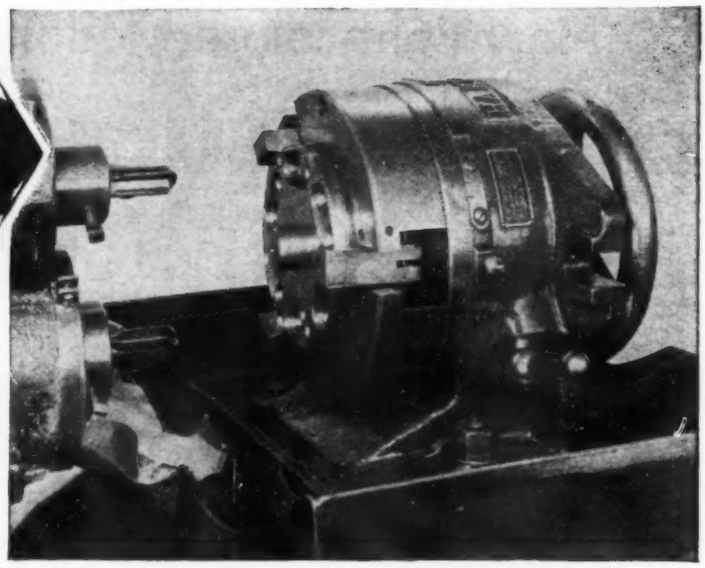
★ ★ ★

Ask your Socony-Vacuum Representative for additional information.

Socony-Vacuum Oil Co., Inc.

and Affiliates: Magnolia Petroleum Co., General Petroleum Corporation

INDEXING on FINISH MILLING *handled quickly and easily with the* HARTFORD SUPER-SPACER



On the application of the Super-Spacer shown here, close tolerances in finish milling are easily maintained. The job is handled by mounting a hand-wheel controlled quick-clamping fixture on the base of the Super-Spacer. Work is held securely in the chuck jaws of the Super-Spacer. Accuracy is assured with this set up as well as positive, fast, precise indexing. Mask plates on the Super-Spacer, an exclusive feature, make error in indexing impossible.

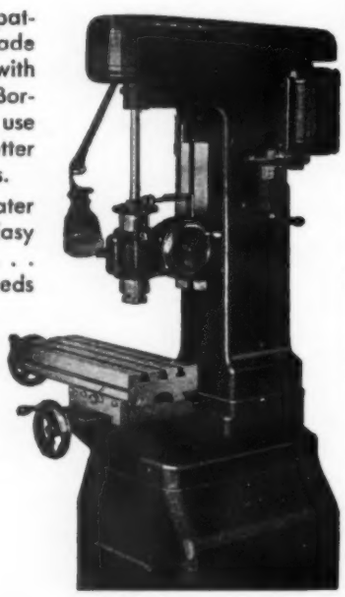
Super-Spacer fields of application are practically unlimited. This spacing device is being widely used in tool room and production milling, drilling, grinding, jig boring and slotting. It can be mounted in any convenient position and may be equipped with attachments and fixtures which make it a device of extreme versatility. *Investigate its possibilities on your work, NOW.*

Send at once for booklet showing how the Super-Spacer is cutting time and costs in many leading shops.

The HARTFORD SPECIAL MACHINERY CO. *Hartford 5, Conn.*

GREATER ECONOMY FOR TOOL ROOMS

Small dies, jigs, fixtures, patterns and models can be made faster and at lowest costs with the LINLEY Milling and Jig Boring Machine. No need to use larger machines that are better suited for higher rated jobs.



Note these points for greater economy in tool rooms: Easy set up, rapid changeover . . . 8 velvet-smooth spindle speeds to 4250 r.p.m. . . . grease-sealed bearings . . . accurate balance of all rotating parts. Fits into 2½ sq. ft. area and has ample (7" x 17½") table size.

Your toolmaker will appreciate this time, money saver.

Get Bulletin . . . now.

LINLEY BROTHERS COMPANY
864 STATE ST. EXTENSION
BRIDGEPORT 1, CONNECTICUT

Better cutting fluids mean Better Machining

Stuart's ThredKut

. . . America's No. 1 heavy-duty cutting Oil for the toughest metal cutting jobs!

FOR FURTHER INFORMATION WRITS

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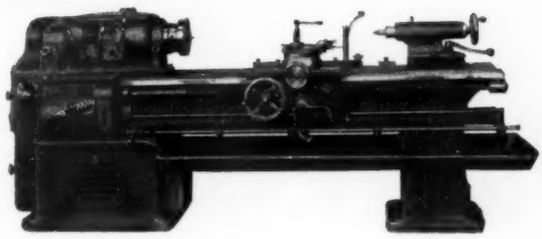
EST. 1905
2729 SOUTH TROY STREET, CHICAGO 23, ILL.

Stuart Oil Engineering Goes With Every Barrel

The Story of the Three BARS



Hendey 16", 18-speed Geared Head Lathe

Once upon a time there were three bars—one tapered long and thin, one with a medium taper and one tapered short and fat. How would you turn them out? Would you just hook up the taper attachment on any lathe? Well you're almost right, but look again—look at their beautiful finish, satin-smooth—no tool marks—it's the most beautiful lathe finish you ever saw—a finish that an ordinary lathe could not match. It took a Hendey Precision Tool Room Lathe with a Hendey Taper Attachment. It took a Hendey because it has such features as—shaved gear headstock, super precision, matched spindle bearings, automatic lubrication—features that mean absolutely no chatter, cuts of unbelievable accuracy and years of trouble-free operation. Production figures will please you, too, for the Hendey 16" Precision Lathe has 18 speeds—a wide range of feeds. If you have a variety of tool work requiring super-precison machining, it will pay to investigate Hendey Tool Room Lathes and Hendey Attachments more thoroughly—write for complete details!

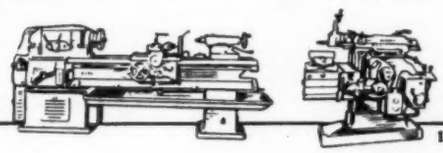
The Hendey Machine Company

Hendey

Main Office and Plant — Torrington, Connecticut

Branch Offices — New York, Chicago, Boston, Detroit, and Rochester

Representatives in — Phila., Cleveland, Los Angeles, Pittsburgh, San Francisco



TOOL ROOM LATHES
12"-16"-18"

SHAPERS
12"-16"-20"-24"-28"

LAPPING AND GRINDING COMPOUNDS

GRADE 17 (Medium) GRADE 18 (Medium Fine)
GRADE 19 (Fine)

SPECIAL COMPOUNDS FOR BRASS AND BRONZE

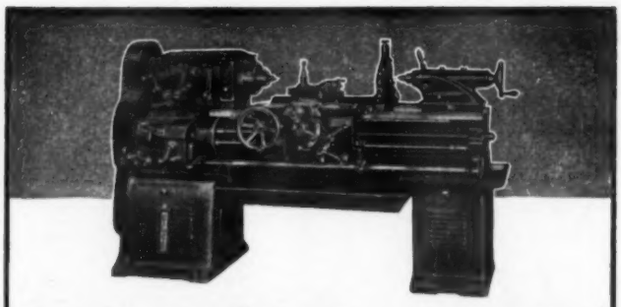
PLUG COCK VALVES

Photo courtesy Hays Mfg. Co.

These three grades of compounds have a special water soluble base that possesses excellent lubricating qualities for grinding various styles of plug and key cock valves. These compounds do not "niggard or score" while grinding—a common trouble with most compounds. They contain abrasives of the proper grit size for grinding or lapping-in brass and bronze plug valves. The finished parts can be washed with ordinary water.

Generous samples sent upon request

UNITED STATES PRODUCTS CO.
518 MELWOOD ST. USP Co. PITTSBURGH, PA.



BRADFORD *Metalmaster* LATHES
have this standard equipment

- 12-Speed Timken Geared Headstock
- Quick Change Gear Device
- Double Wall Apron
- Tailstock
- Compound Rest
- Tool Post with Ring, Wedge, Square
- Steady Rest
- Face Plate
- Dog Plate
- Head Center Bushing
- Chasing Dial
- 2-Centers
- Wrenches
- Motor Mounting and Wiring
- Push Button and Starter
- Vee Belt Drive
- Automatic Lubrication in Head
- Cabinet Legs on Head and Tailstock End of Bed
- Lever Control for Length and Cross Feeds
- Mechanical Apron Clutch Control
- Threaded Spindle Nose

The BRADFORD MACHINE TOOL CO.
1840—1946 CINCINNATI, OHIO

MULTI-DRILL
ADJUSTABLE

DRILL 6 HOLES AT ONE STROKE!—ADJUSTABLE FOR ANY PATTERN

Multiply the production of every drill press . . . make your single spindle tools do the work of 6 with the Multi-Drill attachment. Six spindles are quickly and easily positioned to ***any*** hole pattern by simple adjustments of the locating arms. Fits any drill press. Standard Multi-Drill Spindles using 1/16" to 17/64" drill size handle any hole pattern on or within 5" circles—11/16" minimum centers.

SAVE:
- Drilling time
- Set-up time
- Equipment investment
- Floor space

NOTE: Special spindles are available to permit use of drills 1/16" to 3/16" diameter with corresponding minimum centers of 1/2" and 7/8".

Write for catalog sheets and complete details

COMMANDER MFG. CO.
4229 W. Kinzie Street
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ERRINGTON MECHANICAL LABORATORY
STAPLETON, STATEN ISLAND 4, N. Y.

MULTIPLE HEADS

Super-Sensitive Fixed Center Multiple Drilling Heads

Fixed-Center Auto-Reverse Multiple Tapping Heads

All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles

ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

Capacity

ONE COMPLETE ENGINE BLOCK

per minute!

Ultra-modern broaching machine built by Cincinnati Milling Machine Co. 8 tons of Circle-C used for six sets of tools.

broached with solid inserts of CIRCLE-C Super High-Speed Steel

Forty-eight flat broaches equip this enormous and powerful machine tool used for broaching and machining 8-cylinder cast-iron engine blocks.

The machine builder insisted on the finest high-speed tool steel obtainable for broach inserts.

Circle-C Super High-Speed Steel **was selected by a committee of technical experts because of its recognized reputation for quality, its uniform hardenability and its unequalled cutting capacity.**

Call **Firth-Sterling**

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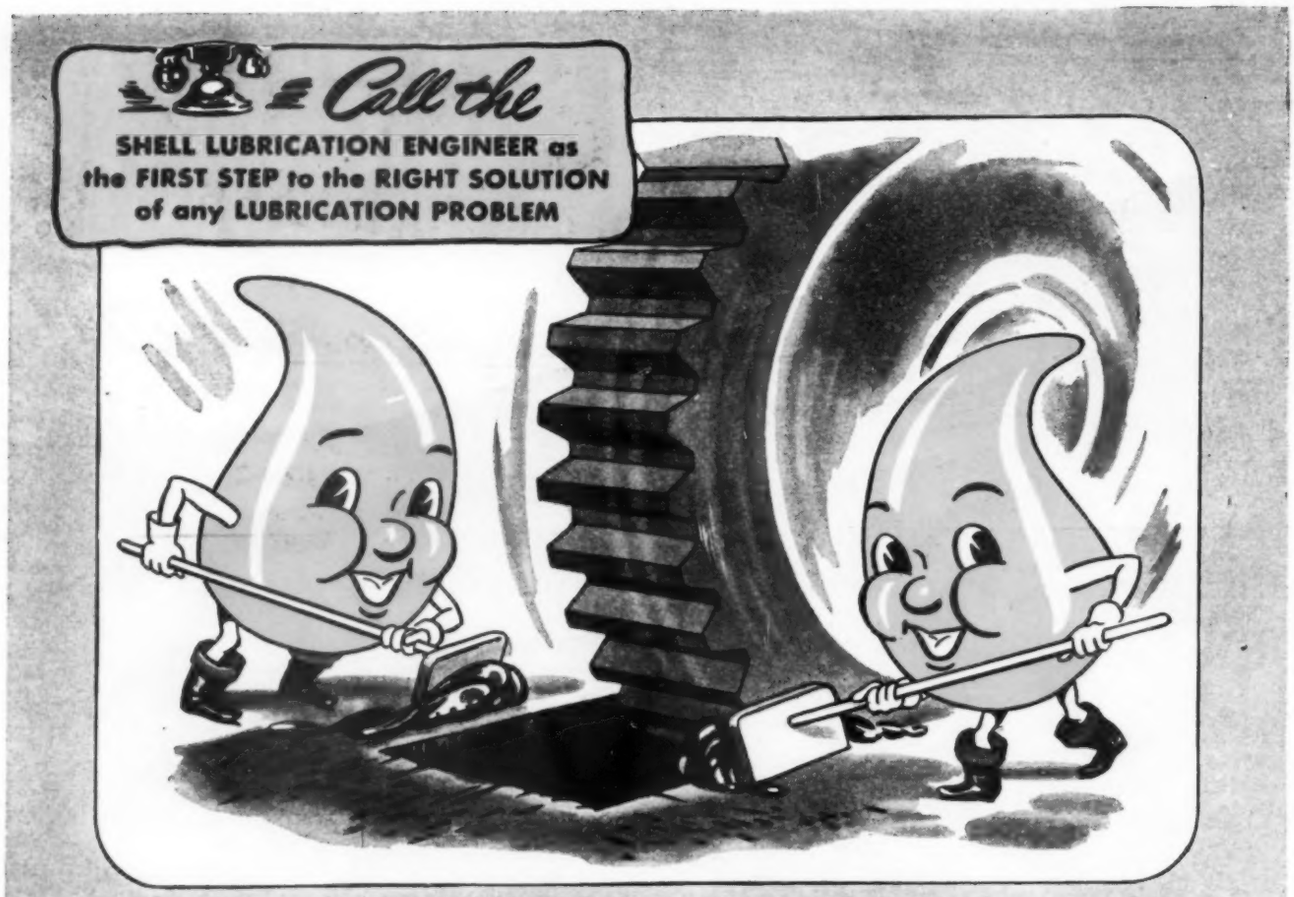


SHELL EXL GREASE OVERCOMES CHANNELING in Gear Case

PROBLEM: Electric hand-held tools designed for infrequent use were being operated continuously in a metal fabrication shop. After two days' service, gears ran hot and tools were noisy. "Channeling" of the grease was recognized as the cause of trouble, and, though a nuisance, a schedule of maintenance overhaul *every other day* had to be maintained.

SOLUTION: When the Shell Lubrication Engineer surveyed the problem, he recommended a Shell EXL Grease. This grease has the consistency required for gear-case use, and also has a "slump" property by which it fills a channel cut by gears. Results were immediate. Gears ran cool, chatter ceased. Maintenance checks and re-greasing were extended to weekly intervals.

CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. For informative literature about Industrial Greases, write Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York or 100 Bush Street, San Francisco 6, California.

SHELL INDUSTRIAL GREASES

SHELL

ABRASIVE No. 1½

HAND FEED SURFACE GRINDER

IDEAL FOR SHORT RUN PRECISION JOBS

MOTORIZED SPINDLE
no belts . . . full power at grinding wheel surface.
.00025" GRADUATED DIAL
sensitive adjustment for super finishing.
LARGE CAPACITY
10" wide, 12" high, 15" long . . . minimum overhang of saddle.
EASILY OPERATED
large, conveniently located handwheels.
DUST PROTECTION
saddle provided with steel dust guards to protect bearings.
ABRASIVE
ACCURACY BOOSTS PRODUCTION

If you will send us serial numbers of Abrasive machines on the Government Surplus Tool list we will endeavor to supply you with information, attachments or repair parts.

SPECIFICATIONS:

WORK CAPACITY
15" long, 10" wide, 12" high.

TABLE SIZE OVERALL
48" x 11¼"

SPINDLE
Removable cartridge type, 1750 R. P. M. Phosphor-bronze adjustable box (front). 2 ball bearings (middle & rear)

GRINDING WHEEL
Standard 12" diameter

FEEDS — ALL HAND FEEDS
Transverse graduated .001"; Vertical .00025". Metric graduations if specified.

DRIVE
1 H. P. motor mounted on spindle

NET WEIGHT
1350 lbs.

Write for complete bulletin.

ABRASIVE MACHINE TOOL COMPANY EAST PROVIDENCE 14, RHODE ISLAND

PRODUCE STAMPINGS COMPLETE-PER-STROKE — SAVING 60% TO 90%

One Dieing Machine equals 5 to 10 conventional presses in production

Complete-per-stroke — speeds up to 600 s.p.m.

.031" BRASS 8400 per hour

.003" SILICON STEEL 36000 per hour

HIGH PRECISION OF PRODUCT

Precision of stampings can be held consistently within .0002" limits when required.

DIE LIFE INCREASED 600% to 1200%

One set of dies outlasts 10 sets

50 TON DIEING MACHINE

Other capacities: 10 tons to 300 tons

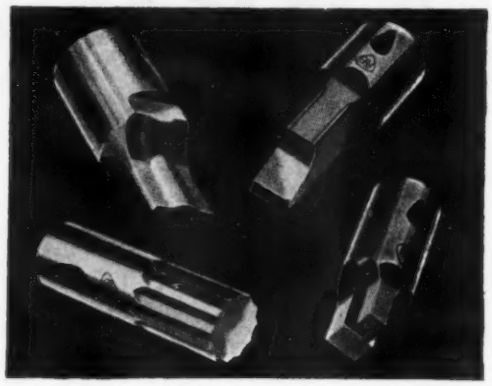
REQUEST ILLUSTRATED "CATALOG 46"

THE HENRY & WRIGHT MFG. CO.

487 WINDSOR STREET HARTFORD 1, CONN.

HENRY & WRIGHT DIEING MACHINES

Service **WITH A PUNCH**



ALLIED'S R-B interchangeable Punch and Die is "standard" in metal working and plastic industries. Standard shapes and sizes carried in stock. Illustrated are four of the thousands of specially-designed punches we have made. Special R-B punches and dies made in any material, shape or size desired. Send for large, illustrated R-B catalog, now.

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Sensitive DRILLING MACHINES

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CINCINNATI OHIO

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

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A card addressed to any of our offices will bring a qualified engineer right to your door.

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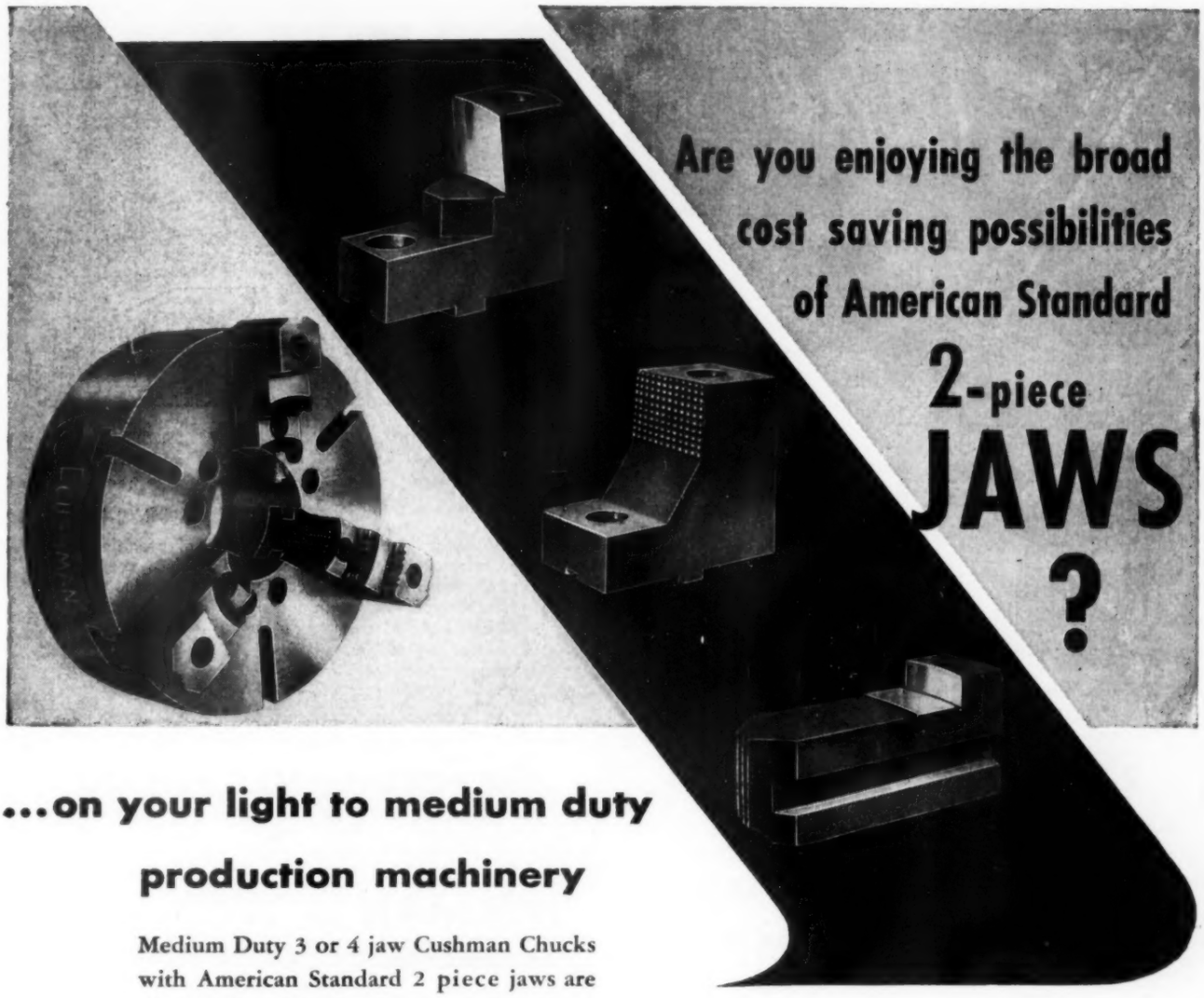
WORCESTER, MASS. for New England

LELAND GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.



Are you enjoying the broad cost saving possibilities of American Standard 2-piece JAWS ?

...on your light to medium duty production machinery

Medium Duty 3 or 4 jaw Cushman Chucks with American Standard 2 piece jaws are the ideal equipment for your tool room lathes, your general purpose lathes and the great majority of lathes in your production departments. Because, with this type of jaw, you remount the top jaws when changing from one form of work piece to another... rather than using expensive work holding fixtures.

With this type of jaw equipment you can make full use of soft blank top jaws. These can be formed to hold all kinds of irregular shaped work pieces. And the cost will be far less than for special face plates or fixtures. With Cushman high standards of precision in chuck manufacture you can depend upon the accuracy of these set-ups for your most exacting work.

Our Engineering Department will be glad to give you further information and help on your own particular problems. Write us, without obligation.

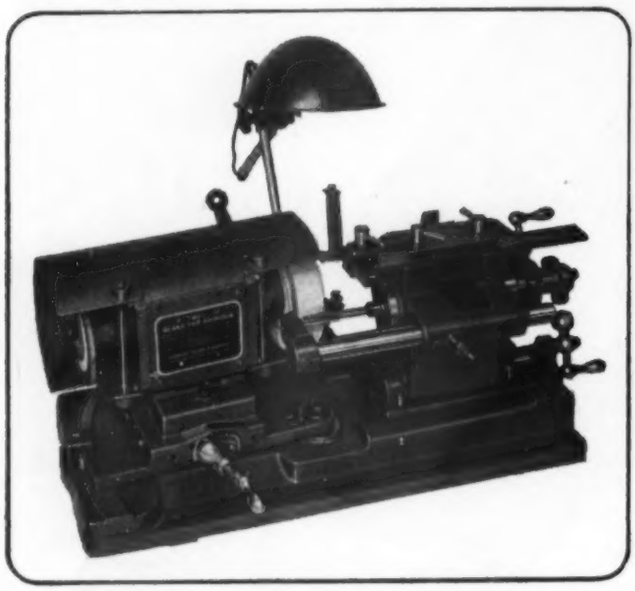
THE CUSHMAN CHUCK CO.
Hartford 2, Conn.

A WORLD STANDARD FOR PRECISION

CUSHMAN CHUCKS

EDWARD Blake COMPANY

634 COMMONWEALTH AVE., NEWTON CENTRE 59, MASS.



Are you getting the MOST out of your TAPS?

If you spend $250 a year on taps, you can profit by using a Blake Tap Grinder. It increases tap life five to ten times—and means thousands of extra holes from every tap. In one set-up and one continuous operation, the Blake sharpens dull taps—maintains them always ready for your production machines, preventing costly delays in your production schedule.

The Blake Tap Grinder is compact, inexpensive and capable. It accurately grinds the chamfer angle and relief on a wide variety of left- and right-hand taps, countersinks and other similar tools. The Blake is simple to operate, fast on set-up and easy to change over. In fact, the machine may be operated by women or semi-skilled operators.

It will pay to learn more about the Blake method for grinding taps. Send the coupon below for complete details.

No Machine is Better than the Cutting Edge of the Tool it Uses.

Please send me Bulletin 544 which gives complete details on Blake Tap Grinders. A.M.

NAME_____ TITLE_____

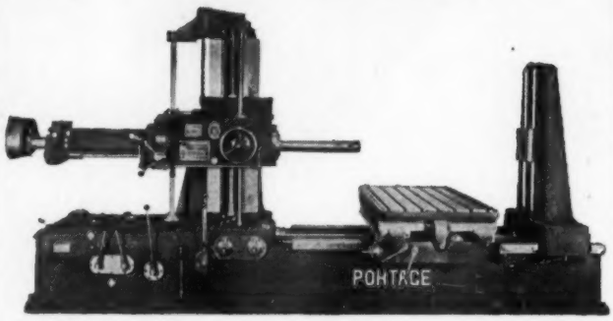
COMPANY_____

STREET_____

CITY_____ STATE_____

BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS

PORTAGE



NO. 4 HORIZONTAL BORING DRILLING & MILLING MACHINE

• A ruggedly built machine capable of operation at maximum speeds and feeds to produce accurately finished work. . . . Machine furnished with coolant type table with either 36" x 60" working surface and 48" cross travel, or 48" x 72" working surface and 60" cross travel. . . . Extra height columns increase working capacity. . . . For greater speed—precision—high production specify PORTAGE.

WRITE for full descriptive bulletin today.

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HOLMAN *BETTER, FASTER HOLE FINISHING*

HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

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MANCHESTER, CONN.

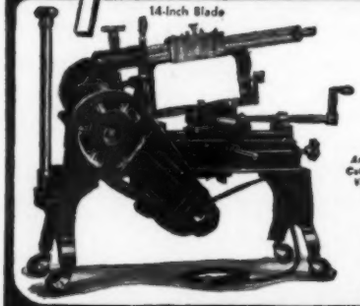
DAVIS KEYSEATER

This low cost machine will handle internal keyseating jobs up to 1¼ in.

Write for illustrated bulletin.

DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

POWER HACK SAW ★



LOW PRICED SELF-CONTAINED
PORTABLE STURDY
READY TO WORK
ECONOMICAL

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WRITE FOR BULLETIN NO. 400

MILLER-KNUTH MFG. CO. OMAHA, NEB.

4610

ROCKFORD Hy-Draulic MACHINE TOOLS

Over sixteen years ago the Rockford Machine Tool Co. introduced the first hydraulic reciprocating machine tool. Today our belief in the superiority of hydraulic design stands justified, for Rockford Hy-Draulic Machine Tools have proved themselves wherever and however employed. The exclusive and highly specialized engineering experience that has been ours is fully applied in each machine tool we build.

Every Rockford Hy-Draulic Machine Tool offers such basic advantages as:

1. Ease of control for quick set-up and fast operation.
2. Stepless Speeds . . . infinitely adjustable throughout a wide specified range. Hy-Draulic tool-head feeds similarly adjustable.
3. Efficient, smooth hydraulic pressure . . . maintains cutting speed as set, no matter how work resistances vary.
4. Smooth, fast reversals and high return-stroke ratios. Oil flow through Hy-Draulic System reverses instantly. Simplicity of Hy-Draulic System holds inertia factors to a minimum.
5. Fine finish and long tool life. Smoothness of Hy-Draulic drive, free of mechanical play and vibration, protects work and cutter.

Rockford Hy-Draulic Machine Tools assure quality work with speed at minimum cost. Let the Rockford sales engineer give you complete information.

Hy-Draulic

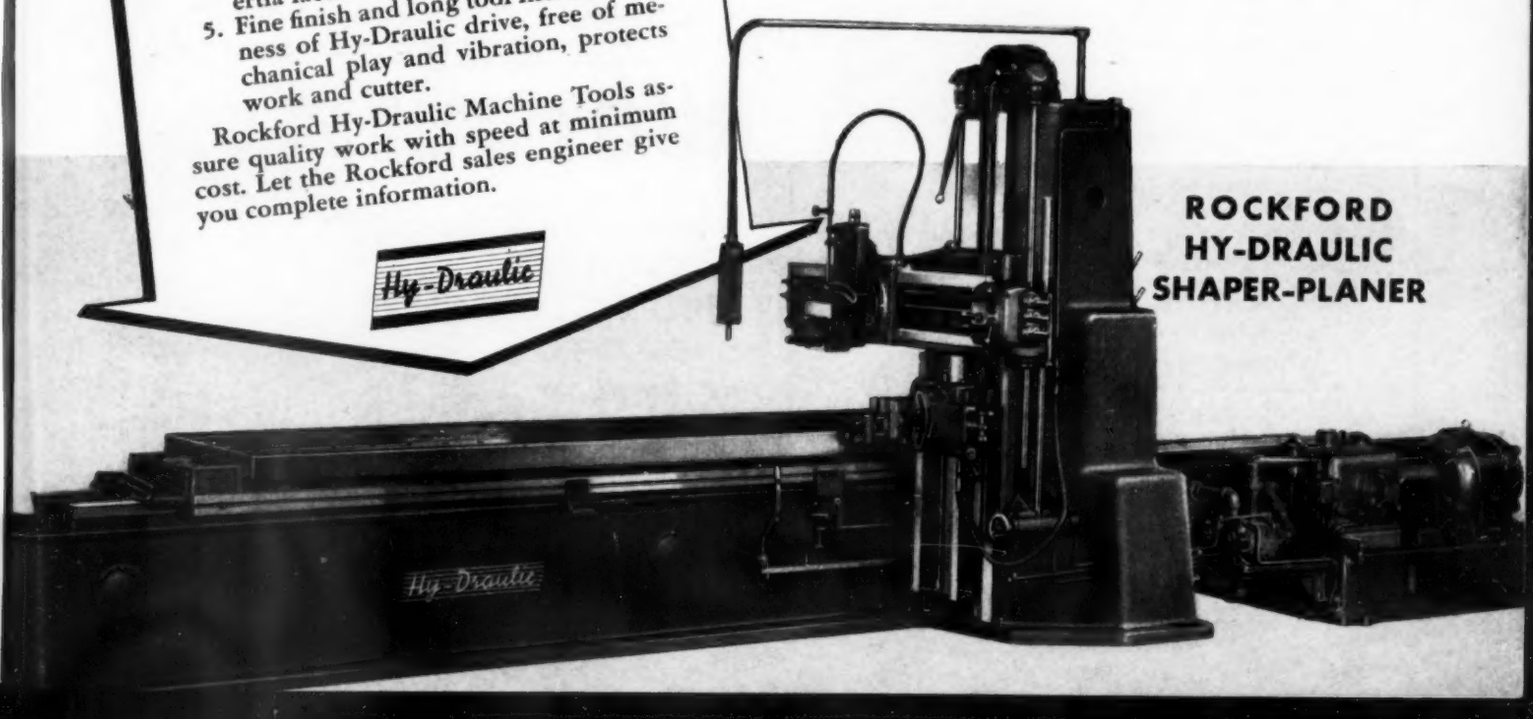
speed plus smooth power

Rockford Hy-Draulic Shaper-Planers provide the operating speed and ease of control for doing the job fast. Rugged construction and smooth hydraulic drive assure quality work whatever the type of cut. Illustrated above is a Shaper-Planer in use at the Universal Engineering Corporation plant, Cedar Rapids, Iowa. Manufacturers of rock and gravel crushers and related equipment, Universal has found the Shaper-Planer a highly productive machine for a wide variety of work; a typical application is shown here, where a rough cut is being made on a cast steel pitman to a depth of $\frac{1}{2}$″ at a 3/32″ feed. Work such as this is performed quickly because cutting and return stroke speeds are high, infinitely adjustable, and may be independently set as desired. Rockford Hy-Draulic Shaper-Planers are built in five sizes with rated stroke lengths from 42″ to 144″. For complete information write for Bulletin 1139.

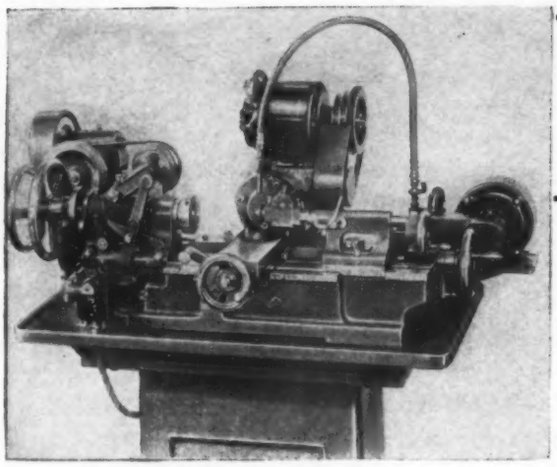
ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS

SHAPERS • PLANERS • SLOTTERS • SHAPER-PLANERS



ROCKFORD HY-DRAULIC SHAPER-PLANER



WALTHAM THREAD MILLERS

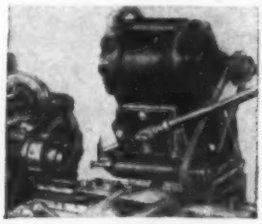
provide versatility and precision in small thread production

Designed especially for small work calling for close tolerances, WALTHAM THREAD MILLERS can be depended on to meet the most exacting specifications for precision parts.

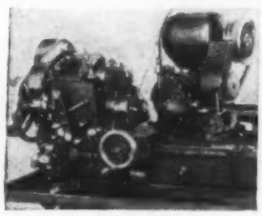
An outstanding feature of these improved machines is the use of three motors, one each for driving cutter, work and pump. Machines can be arranged with speeds suitable for brass or steel or both. Motors are wired so that a single start and stop station will control all at one time.

Standard equipment includes three motors with control, follow rest, milling cutter, indexing device, 5 pitch lead screw and change gears for cutting from 5 to 40 threads per inch.

A wide range of special equipment is available and greatly enlarges the usefulness of this machine. Full details on request. Write for Bulletin 244A.



(Left)—Waltham Thread Miller equipped with Internal Threading Attachment.



(Below)—Waltham Thread Miller equipped with Relieving Head.

CONDENSED SPECIFICATIONS

Swing over carriage—3"
Dia. work handled—2" or smaller
Thread length (work held on centers)—8¾"
Thread length (work held in chuck)—10"
Max. Dist. between centers—12"
Floor Space—48"x34"
Net Weight—850 lbs.

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Type A High Speed Centerless Feed
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puts cylindrical finishing on a cost-cutting basis

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. . . handles both cylindrical and flat work
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. . . automatic belt tension for both abrasive and cushion belts
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. . . feeding unit assures accurate work and is provided with feed speed regulation.

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The accompanying tables show the hardening and tempering series that induce the best properties in 66 High-Speed. The ideal quenching temperature for cutting tools is seen to be 2250 deg. F., with 3 minutes the optimum holding time for greatest refinement and hardness.

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		OIL QUENCH		AIR QUENCH	
Quenching Temp.	Holding Time	Fracture Grain Size	Rockwell Hardness	Fracture Grain Size	Rockwell Hardness
2100	3 min.	9½	64	9½	63
2200	3 min.	9¾	66	9¾	65.5
2250	3 min.	9¾	66	9¾	65.5
2275	3 min.	9¼	66	9½	65

***TEMPERING SERIES** (1-inch-square bar stock)

QUENCH TEMP. 2250 DEG.

	OIL QUENCH	AIR QUENCH
Drawing Temperature	Rockwell Hardness	Rockwell Hardness
850	63.5	63.5
900	65	64
950	66	65
1000	67	65.5
1050	64.5	62.5
1100	64	61.5
1150	62	60

** Single-tempering operation. Double tempering is always recommended for maximum properties in high-speed steel.*

TYPICAL ANALYSIS

C	Mn	Si	Cr	W	Mo	V
.84	.30	.30	4.20	6.50	5.00	1.90

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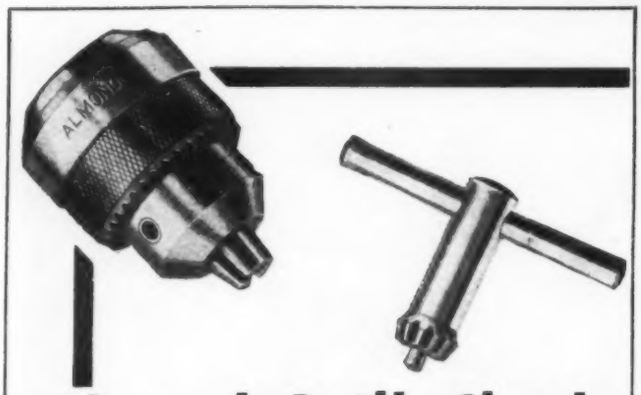

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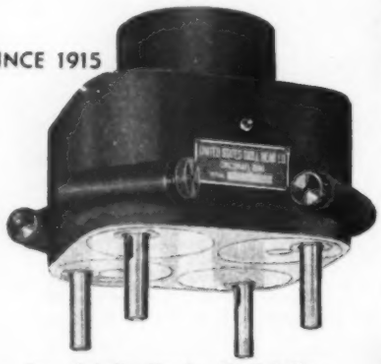

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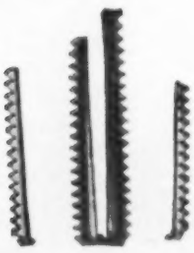

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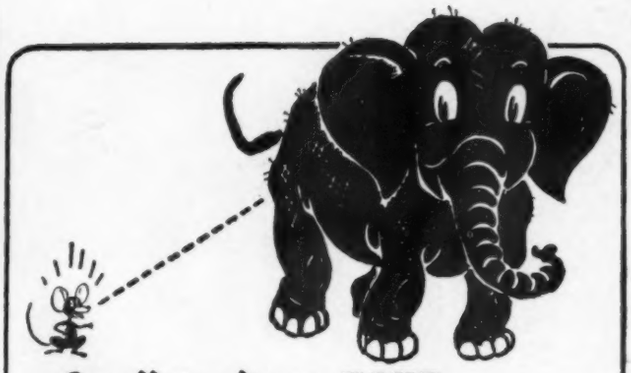

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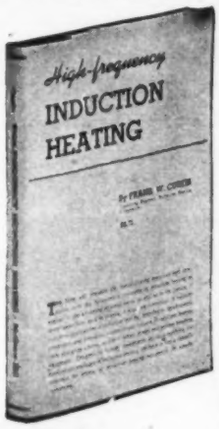

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CONTENTS

1. Principles of Induction Heating
2. Types of Induction-Heating Equipment
3. Design of Induction-Heating Coils
4. Brazing, Soldering, and Joining
5. Hardening and Heat-treating
6. Fixtures for Induction Heating
7. Miscellaneous Induction-Heating Applications
8. Designing for Induction Heating
9. Dielectric Heating

Gives the principles, design details, and techniques of high-frequency induction heating resulting in

- . . . rapid, almost instantaneous heating
- . . . closer control of heating to restricted surfaces
- . . . uniform results according to fixed time schedules, with rejections almost eliminated
- . . . economy of materials through use of higher carbon steel, surface hardened by induction heating
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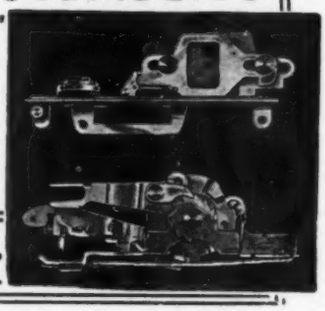

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NEW ADVERTISEMENTS received by 10 A.M. August 27th will appear in the issue of September 12th subject to limitation of space available

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WE HAVE an opening for a first class practical machine tool designer. This is a good opportunity for a man who has had wide experience. Give age, experience and salary expected. P-738, American Machinist, 330 W. 42nd St., New York 18, N. Y.

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SALES EXECUTIVE: qualified by college technical education and actual machine shop experience. Desires position as sales manager or sales engineer with progressive firm. Excellent background as sales manager developing and organizing manufacturers agents and dealers on a national basis. Tools nd gages preferred. Will consider other lines. Current salary $5500 00, age 35, married. PW-745, American Machinist, 330 W. 42nd St., New York 18, N. Y.

MACHINE SHOP Superintendent: Foreman, 10 years as shop supervisor practical experience machine tools, planning production, labor relations, job shop work, maintenance work, tool, die, fixture. East or South states preferred. First class reference. PW-746, American Machinist, 330 W. 42nd St., New York 18, N. Y.

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WANTED BY manufacturers agent: Chicago sales territory, Mechanical Specialties or Tools selling to machinery manufacturers and machine shops. Include full particulars. RA-738, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

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$6,000 to start and unlimited opportunity; huge expansion program promises excellent possibilities for future. The man we want is probably satisfactorily employed at the time, but would like to establish himself for the future. He must be experienced in the design of tools and dies for making small fabricated metal parts in quantity production. Age 30-45. Our present Engineering Staff knows of this advertisement. In replying state age, education, experience, etc.

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330 W. 42nd St., New York 18, N. Y.

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Apply
Employment Office
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BETHLEHEM, PA.

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Must have intensive experience in the designing and production of screw pumps. Write names and addresse of all former employer; age; salary desired.

P-611, American Machinist
330 W. 42nd St., New York 18, N. Y.

WANTED
MECHANICAL ENGINEER

Must be thoroughly experienced in all gear manufacturing problems as well as designing; only those with extensive gear experience need apply. Exceptional opportunity. Write full history including name of university and year graduated; names and addresses of all former employers; age; salary desired.

P-581, American Machinist
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To supervise small machine shop engaged in the development and production of paper making and converting equipment with well established progressive nationally known paper company. Technical education or training desirable but practical experience most important. Must have thorough knowledge machine tools, operation of machine shop equipment and ability to handle men. Good salary. Only well qualified persons willing to locate in the New York area need apply.

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They have a sound record of successfully selling machine tools and other mechanical products requiring engineering in their application.

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Active in this area for past 25 years possessing sales and executive ability invites correspondence with manufacturers of products salable to Machinery and Machine Tool Users. Organization should be high grade and progressive in product and management.

RA-682 American Machinist
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Owner of medium size forging and manufacturing plant located central U.S.A., employing approximately 70 men, desires to get away from production pressure and labor problems. Will consider selling at a reasonable price and on terms if necessary to one or more individuals.

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Rated Capacity—1200 Tons
Working pressure of oil, approx.—2000# p.s.i.
Diameter of main ram—39"
Stroke of main ram—18"
Number of pull-backs—2
Stroke of pull-backs—22"
Number of columns—4
Diameter of columns—14½"
Daylight (ram up)—36"
Distance bet. columns—R to L—90"
Distance bet. columns—F to B—28"
Pressing speed (max.)—13" per min.
Pump—Vickers
Motor—75 HP, 220/60/3

This press is also equipped with one spring suspended ball transfer table and one pair of approach tables.

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14" x 20' Hendey Toolmakers Lathe.
16" x 6' Rockford Toolroom Lathe.
16" x 6' American Motor Driven Lathe.
16" x 8' Lodge & Shipley 12-speed Grd. Hd.
18" x 10' American, Geared Head, Taper.
20" x 10' Hendey with Taper.
20" x 10' American, Motorized. Q.C.G.
24" x 20' American, Motor drive.
48" x 30' Simmons Geared Head, 1941.
14" x 6' Hendey Tool Makers, taper.

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4—#4 Warner & Swasey Hand Screw Machines, arr. Motor Drive.
2—#4 Warner & Swasey Universal Turret Lathe, Motor Driven.
16" Warner & Swasey Brass Lathe.
#2A Warner & Swasey Universal.
#6A Potter & Johnson Automatic Chuckers.
#3R Gisholt Universal like new.
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26" x 26" x 8' Gray Planer, 2 heads.

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P & W 2½" Duplex Spline Miller.
Thread Miller, Hall Planetary #1—24".
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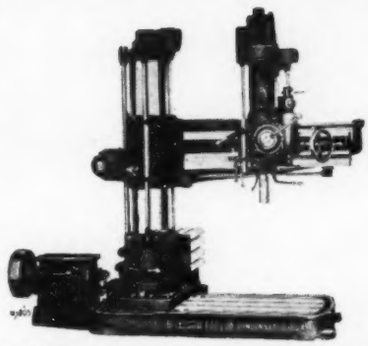

Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

#1, #2 Kempsmith Plain Millers.
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16" Persons-Arter Rotary Surface Grinder.
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#70 Heald Internal Grinder.
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100" Niles-Bement-Pond, 2-head geared motor drive.
72" Cincinnati Heavy Pattern Vertical Boring and Turning Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

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Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
2—Natco #14, 22 spindle Rectangular head Drilling Machine, #2 M. T.

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200 ton A.C.F. Hydraulic Press. Bed 24" x 36", 4-post.
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Hilles & Jones #5 Single End Punch and Shear. Equipped as Plate Shear with 18" Blades. ARR, motor drive, 54" throat.

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24" American Direct Motor Drive.
15" Potter & Johnson, Universal Knee.
16" Gould & Eberhardt, Direct Motor drive.
Slotter 12" stroke New Haven, motor drive.
Rhodes 7" stroke, Shaper.

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Thomson Cutter and Creaser, 12½ x 18½.
Heat Treating Furnaces for the tool room.
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Schuster Wire Straightener & Cut Off, capacity ½" dia. up to 40' long.
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120" x 96" x 24' Simmons Heavy Duty Double Housing Planer. Complete with 4 heads and standard equipment, arranged for reversing motor drive and rapid traverse and including one Reliance 50 HP, 150/900 RPM D.C. motor, frame P-4617, 230 volts serial #644739, one Cutler Hammer control Box #B-871007A7.

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INGERSOLL 24 x 24 x 8' Planer type—1 head
INGERSOLL 36 x 48 x 18' Planer type—4 heads
INGERSOLL 42 x 36 x 16' Planer type—4 hds.
KEARNEY & TRECKER No. 1218 Auto. Timken Bearing—latest type
MOREY No. 12M—2 spindles Profiler and Milling Machine
OHIO Auto. 16" x 72" table—Timken Bearing—latest type 36" longitudinal feed
SUNDSTRAND #33 RIGID MILL DUPLEX—Timken Bearing—latest model
SUNDSTRAND #25 Rigid mill, duplex, Timken bearing, latest type

● THREAD MILLING MACHINES

PRATT & WHITNEY 4½ x 12, 6 x 20, 6 x 60 Model C—latest type
PRATT & WHITNEY 6 x 120, 6 x 132—M.D
MOREY SHIELDS 12 x 30, 12 x 60, 12 x 120, 12 x 192—latest type
SMALLEY GENERAL #20 M.D.

● SHAPERS

JONES 6" Vertical—latest type
LAMAIRE 18" Vertical Hyd., latest type
MOREY 10", 14", Vertical—latest type
PRATT & WHITNEY 6", 10"—Vertical—motor drive
PRATT & WHITNEY 6", 12" Model B—latest

● GRINDERS—Surface

ARTER 8" Rotary Surface
ARTER 30" Rotary Surface—Hyd., latest
ARTER Automatic Piston Ring
BLANCHARD #16A Dial Type, M.D.
BLANCHARD #16—26" Chuck—motor drive
MATTISON 14x16x36" hyd. latest type
MATTISON 20x24x72 hyd. latest type
MATTISON 16 x 24 x 96—Hyd.—latest type
NORTON 10 x 60—Hydraulic—latest type
THOMPSON 12" x 12" x 24" Type B Hydraulic—latest type
THOMPSON 12" x 16" x 48" Type C Hydraulic—latest type

● GRINDERS—Cylindrical Plain and Universal

BROWN & SHARPE #1, #4 Uni. latest type
BROWN & SHARPE #3 Univ. M.D.
LANDIS 10x24 Type C Uni. hyd. latest type
CINCINNATI 12x48 Uni. hyd. latest type
NORTON 12 x 24—type LC
MULTIPURPOSE Univ.—latest type
LANDIS 6 x 18 Self Contained—m.d.

● GRINDERS—Internal, Cutter and Miscellaneous

BRYANT No. 16—16" Chuck Internal
BROWN & SHARPE No. 13 Univ. & Tool—latest type
CINCINNATI No. 2 Plain Tool & Cutter—latest type
CINCINNATI #2, Centerless, motor driven
HEALD No. 70—internal—motor drive
HEALD #72 A3, sizematic internal
HEALD 72A5 pl. internal latest type
HEALD No. 81 Plain Internal—latest type
LEBLOND No. 2 Universal Tool & Cutter; latest type
PRATT & WHITNEY Contour Cutter—latest
OLIVER Univ. and Tool—latest type
OLIVER #510 Drill Grinder
FITCHBURG UNIVERSAL Spline shaft; Hyd.

● BORING MILLS—Horizontal

CINCINNATI-GILBERT 3½" bar; floor type, latest type
FRANKLIN 4½" bar—SPD
GIDDINGS & LEWIS #25T 2½" bar, latest type
LUCAS No. 31—3" Bar—motor drive
NILES BEMENT POND 5½" Bar
NILES BEMENT POND 4½" bar—floor type
NILES BEMENT POND 5" bar—floor type
NILES BEMENT POND 7" bar—floor type
NILES BEMENT POND 6" bar—floor type
PEDRICK 3¾" bar—floor type
P & H #10—3½" bar floor type
OHIO #5F-420 floor type, Timken bearing, 5" bar, latest type

● BORING MILLS—Vertical

BETTS 120"—2-swivel heads, motor drive
BULLARD 24", 36", 42" New Era Type—motor drive
BULLARD 86"—2-swivel heads; motor drive
COLBURN 72" 2-swivel heads AC M.D.
KING 72" 3 heads, latest type, AC M.D.
KING 62" 2-swivel heads AC M.D., PRT
NILES 72" 2 swivel heads D.C. M.D.
NILES BEMENT POND 84" 2-swvl. hds; M.D.
NILES 42", 2-swivel heads, PRT
NILES BEMENT POND 100" 2-swivel heads, PRT

● DRILLS

ALLEN #2, 2-4 spindles—latest type
AVEY No. 2—1 to 6 spindles
BAKER #121 Single spindle—latest type
BODINE No. 42-20 Auto.
BUFFALO #16—4 spindle—latest type
FOOTEBURTE SIPP #2, #3—ss—latest type
HENRY & WRIGHT—2-spindle
NATCO C-13H multiple spindle
PRATT & WHITNEY No. ½B x 50"—2-spindle deep hole—latest type

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● DRILLS—Radial

AMERICAN 3' 11", 4' 11", 5' 11"—latest type
AMERICAN 5' 13" Universal—M.D.
AMERICAN 5' 13" triple purpose, M.D.
CANADY-OTTO 3' 11" new
CARLTON 3' 11", 6' 17", 6' 19", 7' 19" latest type, M.D.
CARLTON 4' 13", 5' 14", 7' 15" M.D.
CINCINNATI BICKFORD 6' 15", 6' 19", superservice, latest type
WESTERN 4' 18", 5' 18", 6' 20"—latest type

● GEAR CUTTING EQUIPMENT

BARBER COLMAN No. 3 Gear Hobber
BROWN & SHARPE No. 13 Gear Cutter
BROWN & SHARPE No. 6 x 60 Gear Cutter
BROWN & SHARPE #44 Gear Hobber
CINCINNATI Gear Burnisher
FELLOWS No. 7, 7A, 72, 77 Gear Shapers
FELLOWS No. 64A 624A Gear Shaper, latest
GLEASON 18" Bevel Gear Gen.
GLEASON #13 Gear Tester
GLEASON Bevel gear tester and lapper
GLEASON 24" Bevel Gear Planer
G & E 12H Gear Hobber Motor drive
GOULD & EBERHARDT 24H Uni. gear hobber
G & E #36B Gear Cutter; spur—Bevel—m.d.
G & E #96H Gear Hobber, with differential
MICHIGAN #854 Gear Finisher, latest type

● LATHES—Turret

BARDONS & OLIVER No. 3—latest type, Timken Bearing
BARDONS & OLIVER #5, #7 Univ. Timken Bearing; chucking
BROWN & SHARPE #1 Hand Screw machine, Timken bearing, latest type
CINCINNATI ACME #1 Universal—Timken Bearing—latest type
CINCINNATI-ACME 5W, Timken Bearing, latest type, 2" bar cap
GISHOLT No. 2L Univ. Timken Bearing —latest type
GISHOLT No. 3, No. 4 Univ. Timken Bearing —latest type
GISHOLT #3D Simplimatics—Timken Bearing—latest type
GISHOLT #4L, 9" hole—cross sliding turret—Timken Bearing, latest type
JONES & LAMSON #3-#5-#7C Univ.; latest type—Timken Bearing
LIBBY #1H—5 Timken Bearing—latest type —5½" hole
MOREY No. 2G, 1" Cap. Timken Bearing
MOREY No. 3 Univ.; 1½" Cap. Timken
MOREY No. 4 Univ.; 2" Cap. Timken Bear.
WARNER & SWASEY No. 3, No. 4, No. 5 Univ. Timken Bearing—latest type
WARNER & SWASEY #3A Universal—motor drive
WARNER & SWASEY #1A, #4A Uni. Timken bearing, latest type

● LATHES—Engine and Mfg.

AMERICAN 36"x25' centers Timken bearing, 2 carriages, taper attach., latest type
AXELSON 24" x 72" centers—Timken Bearing—latest type
BRIDGEFORD 42" x 35' bed—2 car.—M.D.
BRADFORD 14" x 42"—Timken Bearing—latest type
BRIDGEFORD 36" x 28"; 36" x 32'; 36" x 35' bed; 2 carriages
HENDEY 12 x 54 Centers, Mfg.—latest type
LEBLOND 17x14' bed, Timken Bearing, Rapid Production
LEBLOND 20" x 48—20" x 120 centers—Timken Bearing—latest type rapid production
LEBLOND 13"x4' bed Timken bearing, rapid prod., latest type
LO SWING 4x84, 4x60, 8x84, 8x60 Timken Bearing—latest type
HENDEY 20" x 8' Bed Yoke Head—M.D.—taper att.
NILES 36" x 25' centers, 2 carriages, PRT; Timken Bearing
NILES 48x55' centers Timken bearing, 2 carriages, taper attach, PRT, latest type
NILES 36x24' centers "Time Saver", Timken Bearing, 2 carriages, taper attach. PRT, latest type
NILES 60"x10' centers, 60"x15' centers, 60"x35' centers, 60"x40' centers, Timken bearing, one or two carriages, taper attach. PRT, latest type
PITTSBURGH 50" x 30' bed—M.D.
RIVETT Style 918 Bench Type; ball bearing
SIDNEY 17" x 8' Cone Drive

● PLANERS

CINCINNATI 24" Crank—motor drive
CINCINNATI 36 x 30 x 5' Box table, PRT, 1 head—motor drive
CINCINNATI 84x72x18' HYPRO, 4 heads vari-voltage, latest type
CINCINNATI 48x48x20' 3 heads, AC, M.D.
CINCINNATI 120 x 96 x 20'—4 heads box Table, PRT—motor drive
CLEVELAND 48 x 48 x 16' Open side, 3 heads, motor drive
DIETRICH & HARVEY 48 x 48 x 16' 4 heads, Hydraulic—motor drive
GRAY 48 x 48 x 16' 4 heads motor drive
HAMILTON 42 x 42 x 20', 4 heads, motor drive
LYND FARQUHAR 26" open side M.D.
NILES BEMENT POND 96 x 80 x 20' box table 4-heads Hyd. PRT. motor drive
NILES 48x48x12' "Time Saver" 4 heads, PRT, box table, AC, M.D.

● AUTOMATIC SCREW MACHINES

CLEVELAND ⅞" to 2½" Model A
CONOMATIC 3½"—4 spindle—latest type
NEW BRITAIN-GRIDLEY No. 65; 6 spdle; chucking; latest type

● PRESSES

CLEARING TYPE K-1200-30 Knuckle Joint, 200 Tons—latest type
BALDWIN SOUTHWARK 300 ton Vertical Hydraulic. Latest type
FERRACUTE DG-55, drawing; latest type
WATSON STILLMAN Hyd. Straightening Press 20 Ton

● SAWS

CAMPBELL #401 Cutamatic Wet Abrasive Cutting Machine
LUCAS #138 Cold Saw, M.D.
MARVEL #9 Hack, 10 x 10, latest type
MOTCH & MERRYWEATHER #3 Cold Saw—Hyd. latest ype
PEERLESS 6 x 6 Hack Saw—Auto. Feed—latest type
PEERLESS 14" x 14" Hack—latest type

● MISCELLANEOUS

LE BLOND #2 Horiz. Hone—SS Latest type
BARNES #2 Hone SS Latest type
LE BLOND #2 Deep Hole Borer—Timken Bearing—latest type
NILES 30 x 50' Deep Hole Borer Timken Bearing—latest type
MORTON 60" combination Traveling Head Planer—Milling & Drilling
BRINNELL Auto. Direct Reading Hardness Testing Machine
RHENBERG JACOBSEN Centering Machine
PRATT & WHITNEY #3B Jig Borer
YODER Multi. Tube Cutting Machine
DE LAVAL Oil Clarifier
CLEVELAND Hob Relieving Machine

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5 Model RA-6 Acme-Gridley 1" Six Spindle Automatic Screw Machines, motor driven, with full set collets, threading spindles, drill speeders, high speed reaming attachments and bar feed. New in 1941.

Model 1A Warner & Swasey Turret Lathe, motor driven, with complete bar feed, collet chuck and master collet. New in 1942.

AUTOMATICS
5½" Cleveland Model A, single spindle.
16" x 33" Fay Automatic Lathe.
⅜" Cleveland Model M, four spindle.
No. 00, 0, 2G Brown & Sharpe.

BROACHES
LaPointe CPC 24 Hydraulic Vertical.

DRILLS
★ **6 ft. American Radial, enclosed head.**
21" Buffalo Stationary Head.
No. D2 Colburn, single spindle.
42" Barnes, sliding head.
Allen Sensitive Drill, four spindle.
No. 11 Natco Multiple Drill, 16 spindle.
★ **No. 3 Bausch Multiple, 20 Spindle, No. 2 Morse Taper, Rectang. Head 20" x 40".**

GEAR CUTTERS
No. 7 Fellows Gear Shaper, m.d.
No. 6, 6I Fellows Gear Shaper, m.d.
No. 5AC Lees Bradner Gear Hobber.
6" Gleason Str. Bevel Gear Generator.

GRINDERS
36" x 168" Mattison Surface Grinder.
No. 22 Heald Rotary Surface Grinder.
Nos. 16—26", 16—30" Blanchard Surface.
No. 72A3 Heald Gagematic Int. Grinder.
No. 70 and 75 Heald Internal Grinders.
No. 13 Brown & Sharpe Universal & Tool Grinder.
★ **12" x 36" Cinci. Hydraulic Universal, with internal attachment, m.d. New 1942.**
10" x 72" Norton Cylindrical Grinder.
No. 2 Cincinnati Centerless Grinder.
★ **No. 3 Cincinnati Centerless, m.d.**

LATHES, ENGINE
14" x 6' Sebastian, motor in base.
16" x 6' Reed Prentice, g.h., Type AA.
16" x 8' American, g.h.
18" x 10' Hendey, g.h.
24" x 10' American, C.D.
48" x 12' Lodge & Shipley, C.D.
IMP and LR Lo-Swing Lathes, m.d. New in 1940.
15" x 30" Lipe Carbo-matic, new in 1943.

LATHES, TURRET
No. 3A Warner & Swasey, g.h.
No. 2A Warner & Swasey, Timken Bear.
No. 1B Foster, g.h.
No. 4 Warner & Swasey, g.h., new in 1942.
No. 3 Warner & Swasey, g.h., new in 1943.
No. 6D Potter & Johnston Automatic Chucking and Turning Machine.

MILLS
No. 31 Lucas Horizontal Boring Mill.
No. 4A Brown & Sharpe Universal, s.p.d.
No. 3B Milwaukee, plain, m.d.
No. 2 M.H. Cincinnati Plain, m.d.
No. 2H Milwaukee Vert., motor in base.
No. 0-8 Cincinnati Plain Automatic, m.d.
★ **18" Cincinnati Plain, m.d., new 1943.**
No. 2209 Milwaukee, Table 22" x 158".
No. 3-36 Cinci. Hydromatic Duplex, m.d.
No. 6 Whitney Hand Mill.
No. 2 Milwaukee Universal.
4" Pratt & Whitney Spline Mill.
42" Bullard Vertical Boring Mill.

MISCELLANEOUS
2500 Ton Lake Erie Forming Press.
Reliance Sand Blast No. 193A.
No. 100 Micromatic Hydrohoner.
Schraner Crankshaft Lap. Mach., Mod. B.
8" x 7" Troy Vertical Steam Engine.
No. 72 Etna Rotary Swaging Machine.
Gray Nibbler, ⅜" capacity.
Barrett Oil Separator.

PLANERS AND SHAPERS
16" Gould & Eberhardt, s.p.d.
24" American Crank Shaper, c.d.
★ **6" Pratt & Whitney Vertical Shaper.**
38" x 38" x 14' Ohio Planer.
42" x 42" x 20' Cincinnati Planer, D.C. Rev. motor drive.

SAWS
9" x 9" Peerless, Hydraulic.

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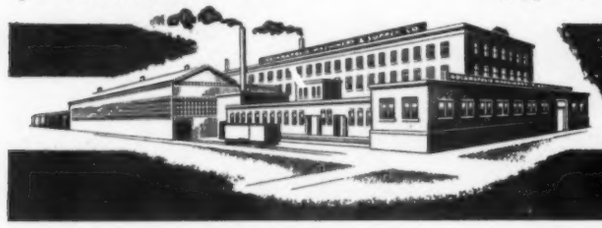

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.

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PUNCH PRESSES

IMMEDIATE DELIVERY FROM STOCK

No. 4½ BLISS, 80-100 Ton Capacity straight side punch press, late model with scrap cutters, double roll feeds, bolster. 15 Hp motors and controls, forced feed lubrication. 21x27 bolster, 4½" stroke, 14½" shut height. In both Single and Double Action Models. Like new, no welds or no cracks. (15 available for immediate delivery.)

No. 6 BLISS, 90-125 Ton Capacity, straight side Punch Presses, late model. With scrap cutters, roll double roll feeds, bolster, 15 Hp motors and controls, forced feed lubrication. 25x30" bolster, 5½" stroke, 16½" shut height. In both Single and Double action models. Like new. This machine is exactly like the above—only slightly larger model.

10—75 ton straight side punch presses adjustable strokes, late model, motorized.

SPOT WELDERS IMMEDIATE DELIVERY 5-100 KVA, Brand new. 5 year guarantee.

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Slightly used, NF-2 & 3, ¼ to 1", 6, 8, 10 M.S. Also 1 to 4" N.S.

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ADJUSTABLE SNAP GAGES. ALL SIZES. ½ to 8".

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Blueprint machines, printer-washer-dryer
Rivett Ball Brg. Precision Screw-Machine
Simmons No. 1A Micro Milling Machine
Drills, high speed single & multiple spindle
Drill, 21" Royesford Bk. Grd. Pr. Feed, New
Drills, sensitive, 2 and 4 Spindle
Drill, #25 Foot-Burt, motor driven
Drills—New—18" Royal Motor driven (10)
Gear cutter, Brown & Sharpe #3—26
Gear cutter, Gould & Eberhardt 42"
Grinder, Webster and Perks #1-¾ motor drive
22" Buffalo Pr. Fd. Motor Drive, New
16"x8' Hendey Lathe, Quick Change Gear
Magic Chucks, #1-2 & 3 and Collets
Pipe Machine, 8" Oster motor drive
Planer 24"x24"x8' Pease, motor drive
Punch & Shear, two ½" & ⅝" capacity
Shaper, 24" Gould & Eberhardt
Turret Lathe, 2" Acme & Warner & Swasey
Welders—Arc & Spot in Stock—New

Outfit: about 27 fine machine tools, drills, lathes, and 5 milling machines, plain and Uni. Tell us definitely what you want as our list is incomplete and only partial.

The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

LATEST MODELS

1—3'-9" Column Cinc. Bickford Radial.
1—3'-11" Column Morris Radial.
1—3'-11" Column American Radial.
2—72" King Vertical Boring Mills.
2—36" x 84" Centers American Lathe.
No. 2 Warner & Swasey Grd. Hd. Timken Brg.
1—2H Kearney & Trecker Vertical Miller.
1—#3 Cincinnati Vertical Miller inbuilt Rotary Table.
24" Bullard UTL. Spiral Drive.
6" x 18" Thompson Type "F" Grinder.

Wigglesworth Machinery Co.

203 Bent St. **Cambridge, Mass.**

LIQUIDATION

OF

MACHINE SHOP EQUIPMENT

BARGAINS BARGAINS

BORING MILLS—Vertical

COLBURN 2 swivel heads, AC, MD
KING 62" 2 swivel heads, PRT, AC, M.D.
NILES 72", 2 swivel heads, DC, M.D.

DRILLS—Radial

WESTERN 3' SPD
AMERICAN 4' 11" triple purpose AC, M.D.
AMERICAN 4' 11" triple geared AC, M.D.
BICKFORD 4' 11" AC, M.D.
CARLTON 4' 13" AC, M.D.
CINCINNATI BICKFORD 4' 11" AC, M.D.
DRESES 4' 13" AC, M.D.
MORRIS 4' 11" AC, M.D.
MUELLER 4½' 9" AC, M.D.
MUELLER 4' 11" AC, M.D.
REED PRENTICE 4' AC, M.D.
RYERSON 4' 11" AC, M.D.
AMERICAN 5' 11" triple geared AC, M.D.
AMERICAN 5' 13" triple purpose AC, M.D.
AMERICAN 5' 13" triple geared AC, M.D.
AMERICAN 5' 13" Universal triple geared AC, M.D.
BICKFORD 5' 11" AC, M.D.
BICKFORD 5' 13" AC, M.D.
CARLTON 5' 15" AC, M.D.
CINCINNATI BICKFORD 5' 13" AC, M.D.
DRESES 5' 15" AC, M.D.
FOSDICK 5' 14" AC, M.D.
NILES BEMENT POND 6' 15" Universal AC, M.D.
REED PRENTICE 6' AC, M.D.
COLBURN #14, 2 spindle heavy duty

GRINDERS

BRIDGEPORT 18 x 110" face and knife
BROWN — SHARPE #13 Universal, M.D.
BRYANT #6 Internal, M.D.
DIAMOND 84" face and knife, M.D.
NORTON 10" x 18" plain cyl., M.D.
SELLERS #1 Tool Grinder
SELLERS #2 Universal Tool Grinder

LATHES—Engine & Turret

BARDON & OLIVER #7 Universal, arranged for bar work, latest type
WARNER & SWASEY #1A Universal, arranged for bar work, Timken bearing

MILLING MACHINES

CINCINNATI #5 Plain, high power, M.D.
CINCINNATI 48" duplex automatic SPD
KENT OWENS #1 hand

GEAR EQUIPMENT

GLEASON #40 spiral Bevel Gear Planer
GLEASON #12 Grinder

PLANERS

BELMAR 36 x 36 x 10' 2 heads, AC, M.D.
BICKETT 36 x 36 x 12' 3 heads, AC, M.D.
CINCINNATI 36 x 36 x 8' 2 heads box table, AC, M.D.
CINCINNATI 36 x 36 x 10' 2 heads, AC, M.D.
CHANDLER 36 x 36 x 20' 4 heads, AC, M.D.
GRAY 36 x 36 x 10' 2 heads, AC, M.D.
GRAY 36 x 36 x 8' Box table, 2 heads, AC, M.D.
LIBERTY 36 x 36 x 8' 3 heads AC, M.D.
NILES BEMENT POND 36 x 36 x 10', 3 heads, box table, DC, M.D.
OHIO 36 x 36 x 10' 2 heads, AC, M.D.
WOODWARD & POWELL 36 x 36 x 12' 3 heads, DC, M.D.
WOODWARD & POWELL 36 x 36 x 12' 4 heads, AC, M.D.
WOODWARD & POWELL 36 x 36 x 13' 4 heads, AC, M.D.
CINCINNATI 38x38x10' 2 heads, AC, M.D.
CINCINNATI 42 x 36 x 12' 2 heads, AC, M.D.
NILES BEMENT POND 42 x 42 x 12' 2 heads, AC, M.D.
OHIO 42 x 42 x 20' 2 heads, AC, M.D.
POND 42 x 42 x 12' 2 heads, AC, M.D.
WOODWARD & POWELL 42 x 42 x 10' 3 heads, AC, M.D.
WOODWARD & POWELL 42 x 42 x 10' 4 heads, AC, M.D.
GRAY 44 x 36 x 12' 4 heads, AC, M.D.
BELMAR 48 x 48 x 12' 3 heads, AC, M.D.
DETRICK & HARVEY 48 x 48 x 10' open side, box table, 3 heads, AC, M.D.
DETRICK & HARVEY 48 x 48 x 12' open side, 3 heads, D.C. M.D.
GRAY 48 x 48 x 14' 4 heads AC, M.D.
HAMILTON 48 x 48 x 16' 4 heads, DC, M.D.
NILES BEMENT POND 48 x 48 x 16' 4 heads AC, M.D.
NILES BEMENT POND 48 x 48 x 16' 2 heads, AC, M.D.
NILES BEMENT POND 48 x 48 x 14' 3 heads, AC, M.D.
PATCH 48 x 48 x 14' 4 heads, DC, M.D.
POND 48 x 48 x 16' 2 heads, AC, M.D.
PUTNAM 48 x 48 x 18' 4 heads, AC, M.D.
GRAY 54 x 42 x 10' 2 heads, AC, M.D.
NILES BEMENT POND 54 x 54 x 12' 2 heads, box table, AC, M.D.
CINCINNATI 60 x 48 x 14' 4 heads, AC, M.D.
GRAY 60 x 48 x 16' 3 heads, AC, M.D.
WOODWARD & POWELL 84 x 48 x 18" 2 heads, AC, M.D.

LEVELING & STRAIGHTENING ROLLS

CLEVELAND 50" x 10" 8 rolls
NILES BEMENT POND #6 7' x 14" 6 rolls

MISCELLANEOUS

BAUSCH radial tapper
BETTS 18" Slotter
CINCINNATI 28" Shaper, 2 heads
NEWTON 15" Slotter, DC, M.D.
NILES 18" slotter, DC, M.D.

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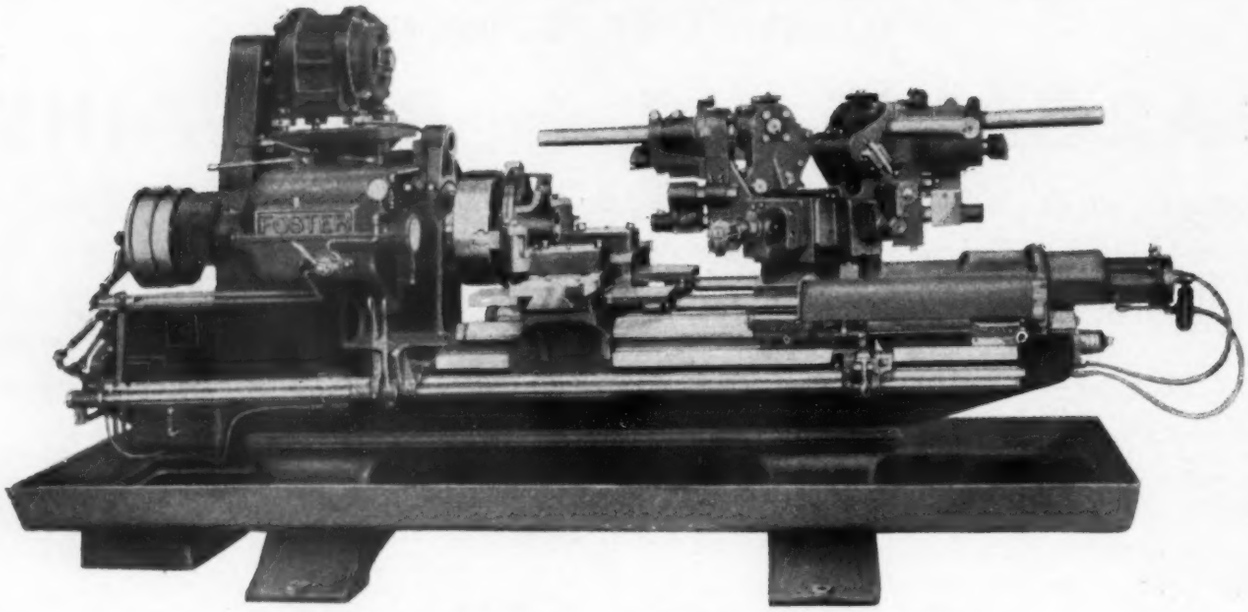


1-F • 3-F • 4-F FOSTER

FASTERMATICS

TURRET TYPE — Slightly Used

With these machines, at our prices, you can machine your parts faster, cheaper, accurately. Simple to operate. No skilled operators required. Ready for operation. No waiting for motors—they are on the machines now. Many tools are with these machines—no extra cost. Check with the manufacturer or we can show you how to cut your costs and increase your output with these machines.

ARE YOUR JOBS SIMILAR TO THESE:

Gear Blanks, Bearing Sleeves, Shafts, Large Sprockets, Ring Gears, Retainer Rings, Steel Hub Caps, Cylinders, Chuck Bodies, Bell Housings, Fly Wheels.

★

SPECIFICATIONS

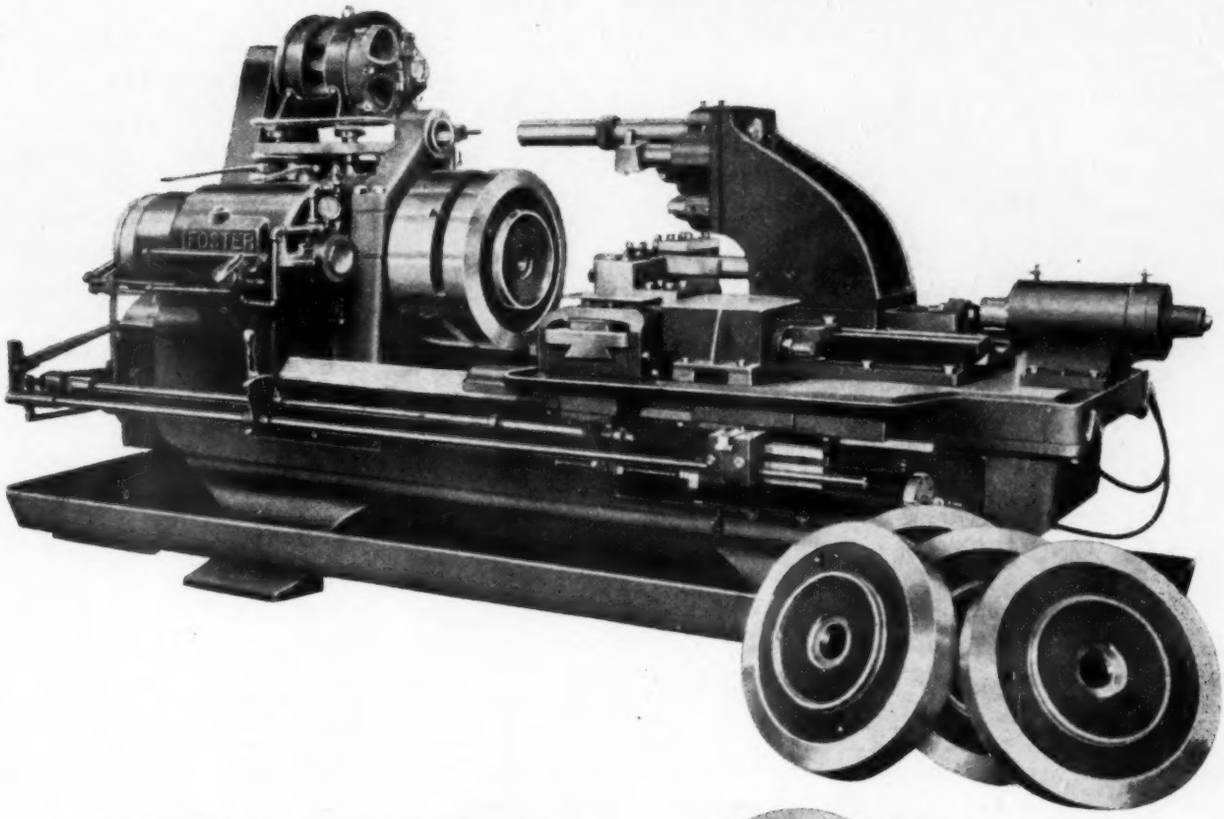
	1-F	3-F	4-F
SWING			
Over bed	19	27 1/2	35
HEAD			
No. of spindle speeds	8	12	12
Dia. hole thru spindle	2 1/8	3 3/4	5 1/8
Center of spindle to top of ways	8 1/4	11 1/2	13 1/2
CROSS SLIDE			
Width of cross slide	7	9	10
Length of cross slide	15 1/2	19 1/2	25
Max. travel-cross	2 3/4	3 5/8	6
TURRET			
Dia. across flats	9 7/8	15	20
Dia. tool holes	1 1/2	3 3/4	5
Max. dist. Sp. nose to tur. face	30 7/8	41 5/8	59 1/2
Effective turning mount	8	12	18
Width of bed—C to C of Vees	9 7/8	16	24

EMERMAN MACHINERY CORP.

875 W. 120TH STREET — CHICAGO 43, ILLINOIS

IMMEDIATE DELIVERY!

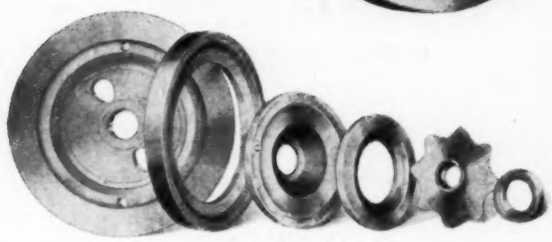
READY TO OPERATE.....



1-F, 3-F, 4-F, FOSTER

FASTERMATICS

PLATEN TYPE—*slightly used*



One man can operate several machines. Skilled turret lathe operators are not required. Change overs are made quickly and easily. Machines are equipped with motors, pumps, chucks and tools at no extra cost. Never before could you buy these fine labor-saving machines at such low prices.

ARE YOUR JOBS SIMILAR TO THESE:

Flywheels, Retainer Rings, Bearing Sleeves, Gear Blanks, Chuck Bodies, Bell Housings, Steel Hub Caps and many other multiple simultaneous large part production items.

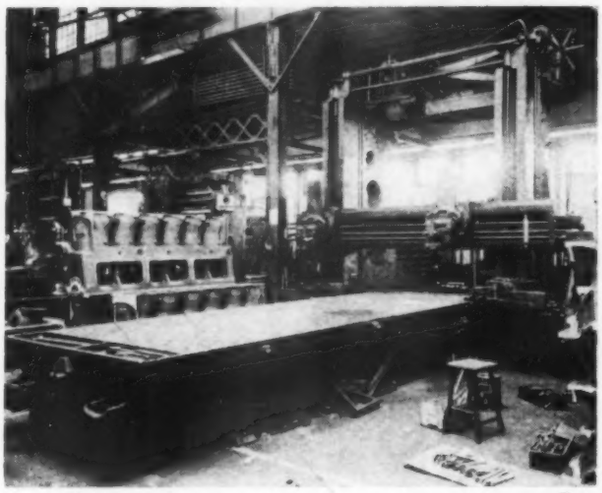
★

SPECIFICATIONS

	1-F	3-F	4-F
SWING			
Over Platen	12 1/4	18 1/4	22 1/4
HEAD			
No. of spindle speeds	8	12	12
Dia. hole thru spindle	2 1/8	3 1/4	5 1/8
C. of spindle to top of platen	6 1/2	9 1/4	11 1/4
PLATEN AND MAIN SLIDE			
Max. travel of platen	10	12 1/2	18
Max. travel of main slide	4	4	8
Width w. surf. of platen	26	34 1/2	42

EMERMAN MACHINERY CORP.

875 W. 120TH STREET — CHICAGO 43, ILLINOIS



Sellers worm gear, double housing Planer, 96" x 96" x 22' table, direct drive by 50 HP, DC reversing motor, and 10 HP motor for raising rail, 4 heads, $9000.00 F.O.B. car.

2—Brown & Sharpe #3 geared head Vertical Millers, $1100 each.

Brown & Sharpe #4B geared head Plain Miller, $1200.

American enclosed head 6' Radial Drill, $1800.

Bullard 36" Vertical Boring Mill, with side head, $1000.

Heald #22 Rotary Surface Grinder, 12" magnetic Chuck, $1000.

Cincinnati #2 Centerless Grinder, 12 yrs. old, $1000.

Acme geared head #2 Universal Turret Lathe, 2", $600.

American geared head Lathe, 30" x 60" c.c. with motor & chuck, $1800.

Bullard 42" Vertical Boring Mill with side head, "New Era", serial 14,777, $3250.

2—New Britain, model 61, 6 spindle, 1⅝" automatic Bar Machines, set up for second operation work, 1942, used 2 yrs. Cost $17,000 new, now $4950 each.

Other Good Machine Tools

GENERAL MACHINERY AND EQUIPMENT CO.

180 South 15th St., HARRISBURG, PA.

OTT MACHINERY SPECIALS

AUTOMATICS, Acme 9/16" & 1" Mod. C 5 spdls.
GREENLEE 2" 6 Spdl. M.D.
AUTOMATICS, Gridley, 9/16" x ⅞" Model G
AUTOMATICS, Cone, 1¼", 1½", & 2⅝" 4 spdle.
AUTOMATICS, Gridley, 1¼, 1⅜, 2¼", & 2⅝ Model F, M.D.
AUTOMATICS, Gridley, 2¼, 3¼, & 5¼" M.D.
AUTOMATICS, Cleveland 1¼, 1½, 2, 2½, 3½ & 4¾" Model A, M. D.
AUTOMATICS, Cleveland ⅞, 1¼, & 2" Mod. B
CLEVELAND 3½" Model K-4 M.D.
AUTOMATICS, Potter & Johnston #5a & 6a, M.D.
CONOMATICS, 1⅝"—8 spindle, M.D.
DRILLS, High Speed B. B. 1 to 6 spindles
GEAR HOBBERS, #3 Barber-Colman, M.D.
GEAR SHAPERS, #6 Fellows, M.D.
GENERATOR, Gleason Spiral Bevel Gear 10"
GRINDERS, Brown & Sharpe #2 & 3 Universal
GRINDER, Brown & Sharpe #11 Plain, M.D.
GRINDER, Heald #72A Hydraulic, 2 M.D.
GRINDER, Norton 10"x36" Hydraulic, M.D.
GRINDERS, Landis Hydraulic, 6"x18", M.D.
GRINDERS, Pratt & Whitney 12" Vert. Surface
LATHES, Hendey, E.B.M. type, 14"x7' & 8' M.D.
LATHES, Hendey, 16"x6' & 8' M.D.
LATHES, Reed-Prentice, 24"x12' G. H. M. D.
LATHES, Rockford, 16"x8' Geared Head, M.D.
LATHES, Turret Warner & Swasey #4 G.H.M.D.
LATHES, Morey #3 G.H. Turret, M.D.
LATHES, Lo-Swing 4"x36" Seneca Falls
MILLING MACHINES #2B Milw. & Vert. Hd.
MILLING MACHINES, Reed-Prentice #2V Vert.
MILLING MACHINES, Milwaukee #1B Universal #2, 2B & 3B Plain, M.D.
PLANER, Gray 30"x30"x8' two rail Hds.
PLANER, Ohio 42"x42"x10' One Head, M.D.
TAPPERS, Garvin 2X, M.D.
Thread Roller, Watson-Flagg. Late type—3/16" to 2⅛" cap.

OTT MACHINERY SALES, INC.
542 Second Avenue
Detoit 26, Mich.

MINA MEMBER

30" PRATT & WHITNEY SINGLE SPINDLE VERTICAL MILLER AND PROFILER

Code 18011. Serial M1482-124. Motor driven with motors, 220 volt, 3 phase, 60 cycle. Table working surface 24x 30". Longitudinal table travel 36", cross slide table travel 41½", vertical movement of head 8", table top to spindle end minimum 7⅝"; max 15⅝".

J. L. LUCAS & SON, INC.
BRIDGEPORT 5, CONN. Tel. 9-3393

LATE TYPE MACHINERY

RIGIDTURNER 8 SPINDLE CLEVELAND MODEL 8618
NEW BRITAIN GRIDLEY NO. 412 ROTATNG 4 SP. CHUCKERS. (5)
DENVER-ACME 6.2 TURRET LATHES (12)
LO-SWING AUTOMATIC 14"x32" and 5"x22"
MOREY TURRET LATHE #3 UNIVERSAL
LEES BRADNER THREAD MILLERS. No. 40 (3)
COULTER TYPE H, HOB THREAD MILLERS (5)
36"x14' INGERSOLL SLAB MILLER, 2 SIDE HEADS
KINGSBURY 8 STATION AUT. INDEXING DRILLING AND TAPPING MACHINE
CRONITE ROTO HYD. CUT OFF MACHINE

CONTINENTAL SALVAGE & MACHINERY CORP.
1836 Euclid Ave. Cleveland 15, O.

POWER PRESSES

No 96A Toledo Double Crank Bed 44x48" 250 TONS

AARON MACHINERY CO., INC.
45 CROSBY STREET NEW YORK, N. Y.

JIG BORERS

3—FOSDICK all geared, single spindle #4 Morse Taper vertical jig boring machine complete with motor and control, precision table indexing and work locating equipment.
PRICE: $3,000 net each

1—CLEEREMAN all geared, single spindle #4 Morse Taper vertical jig boring machine complete with reversing motor and control, precision table indexing and work locating equipment.
PRICE: $4,000 net each

May be inspected in our tool room. All equipment in excellent condition.

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Minneapolis 13, Minnesota

THE LARGEST MACHINE TOOL PLANT IN THE U.S.A.

Eastern OFFERS FROM STOCK

DEVOTED EXCLUSIVELY TO REBUILT MACHINERY

ENGINE LATHES

14"x30" centers Springfield, m.d. in base, latest
14"x6' Pratt & Whitney, cone
14"x8' Bradford, cone
14"x8' Pratt & Whitney, cone
16"x8' Monarch, m.d. in base, taper
16"x6' Hendey Geared Head, m.d., taper
14"x6' Hendey Geared Head, m.d., taper
18"x7' Hendey Geared Head, m.d., taper
18"x48" centers Monarch, m.d. in base, latest
18"x8' Lodge & Shipley, cone
18"x8' Rockford, cone
20"x8' Springfield, m.d., taper
23"x12' LeBlond Geared Head, m.d., taper
24"x72" centers Lodge & Shipley, m.d. in base, taper, latest
24" raised to 28"x10' Hendey Geared Head, m.d.
24"x16' Niles, cone
25"x10' LeBlond, cone
26"x14' Bridgeford, motorized, taper
27"x16' LeBlond, cone, taper
30"x12'6" Niles-Bement-Pond, m.d., taper
30"x13'6" Niles-Bement-Pond, m.d.
30"x16' Bridgeford Geared Head, m.d., taper
30"x26' Lodge & Shipley Selec. Head, m.d., 2 carriages
30"x28' Niles "Time Saver" Geared Head, m.d., latest
36"x10' Putnam, cone
36"x12' Lodge & Shipley Selec. Head, m.d.
36"x12' Wright, cone
36"x21' centers Putnam Geared Head, m.d.
36"x28' 6" Niles Heavy Duty, m.d., latest
36"x28' 6" Niles Heavy Duty, taper, m.d., latest
36"x30' Lodge & Shipley Triple Geared Selec. Head, m.d., 2 carriages
36"x32' centers Putnam Geared Head, m.d., 2 carriages
36"x36'6" bed Niles Heavy Duty, m.d., 2 carriages, latest
42"x26' American Geared Head, m.d.

UNIVERSAL MILLING MACHINES

No. 2A Brown & Sharpe, m.d.
No. 3A Brown & Sharpe, m.d.
No. 4A Brown & Sharpe, m.d.
No. 4 Cincinnati H.P., m.d.

PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
No. 1A Milwaukee, m.d. in base
No. 1M Cincinnati, m.d.
No. 2 Cincinnati H.S. Dial Type, m.d. in base, latest
No. 2 Cincinnati, cone
No. 1½ Cincinnati, cone
No. 2HL Milwaukee, m.d. in base, latest
No. 3B Brown & Sharpe, m.d.
No. 4B Brown & Sharpe, m.d. in base, double overarm
No. 4B Brown & Sharpe, m.d.
No. 4 Cincinnati M.S. Dial Type, m.d. in base, latest
No. 4 Cincinnati H.P., m.d.
No. 4S Cincinnati, m.d.
No. 4H Milwaukee, m.d. in base
No. 5B Heavy Brown & Sharpe, m.d.
No. 5 Cincinnati H.P., rect. overarm, National Standard Spindle, m.d.
No. 5 Cincinnati H.P., rect. overarm, m.d.

VERTICAL MILLING MACHINES

No. 2 Brown & Sharpe, s.p.d.
No. 2 Cincinnati, m.d.
No. 2M Cincinnati, m.d.
No. 3 Cincinnati, m.d.
No. 3 Cincinnati, m.d. in base, Timken
No. 3B Milwaukee, m.d. in base
No. 3B Milwaukee, m.d.
No. 3V Toledo, s.p.d.
No. 4 Cincinnati, m.d.
No. 4 Cincinnati, m.d., Timken, latest
No. 5 Brown & Sharpe, cone
No. 5 Reed Prentice, m.d., Timken, latest type
No. 5 Jackson, m.d.
No. 6 Becker, cone
2 spindle Newton, m.d.
No. 1 Beaman & Smith, belt
No. 28-60 Cincinnati 2 spindle Vertical Hydro-Tel, m.d., latest

MANUFACTURING MILLING MACHINES

No. CT-36 Lees-Bradner Thread, m.d., latest
No. CT-54 Lees-Bradner Thread, m.d., latest
No. 2-24 Cincinnati Plain Automatic, m.d., latest
No. 3-36 Cincinnati Duplex Hydromatic, m.d.
No. 4-48 Cincinnati Plain Hydromatic, m.d.
No. 34-36 Cincinnati Duplex Hydromatic, tracer control, latest
6" Taylor & Fenn Model M54 Duplex Spline, m.d.
6x20" Pratt & Whitney Type B Geared Head Thread, m.d. in base
6x14", 6x48", 6x80" Pratt & Whitney Thread
18" and 24" Cincinnati Plain Automatic Millers
24" and 48" Cincinnati Duplex Automatics
Hall Planetary Thread, m.d.

MANUFACTURING LATHES

No. 4 R. K. LeBlond Boring Lathe, 37' bed, 14' 4" boring length, 13" hole thru spindle, latest type
No. 9 LeBlond Multi-Cut, m.d.
3½x36" LoSwing, s.p.d.
3x80" LoSwing, s.p.d.
4x60" LoSwing, m.d.
8x84" LoSwing, m.d.
8x132" LoSwing, m.d.
9x12" Sundstrand Mfg., s.p.d.
9x14" Porter-Cable, m.d.
13x24" Coulter Automatic Threading, m.d.
13x96" Coulter Automatic Threading, m.d.
16"x6' Cincinnati, m.d. in base
17x124" LeBlond Rapid Production, m.d. in base, latest
20"x8' LeBlond Mfg., m.d.
Niles-Bement-Pond Quartering Machine, m.d.

PLANERS

24"x24"x6' Pond, 1 head, belt
30"x30"x10' American, 1 head, belt
30"x30"x10' American, 2 heads, belt
30"x30"x14' G. A. Gray, 2 heads, belt
32"x32"x16' G. A. Gray, 2 heads, belt
36"x36"x10' Niles, 2 heads, belt
36"x36"x12' Woodward & Powell, 3 heads, m.d.
36"x36"x12' Powell, 2 heads, m.d.
36"x36"x16' G. A. Gray, 2 heads, m.d.
36"x36"x18' Niles-Bement-Pond, 2 heads, reversing m.d.
36"x36"x20' G. A. Gray, 2 heads, belt
36"x36"x20' Cincinnati, 2 heads, belt
38"x38"x20' G. A. Gray, 2 heads, belt
42"x42"x26' G. A. Gray, 2 heads, m.d.
42"x42"x26' Cincinnati, 4 heads, m.d.
48"x48"x18' Detrick & Harvey, 4 heads, reversing m.d.
48"x48"x30' Cincinnati, 4 heads, m.d.
48"x48"x40' Sellers, 2 heads, reversing m.d.
50"x48"x32' Niles - Bement - Pond, reversing m.d., 4 heads
60"x60"x20' G. A. Gray, 4 heads, m.d.
66"x60"x40' Niles - Bement - Pond, reversing m.d., 4 heads
72"x72"x24' Niles - Bement - Pond, reversing m.d., 4 heads
72"x72"x36' Niles, 4 heads, reversing m.d.
96"x72"x18' Pond, 4 heads, m.d.

PLAIN CYLINDRICAL GRINDERS

6x18" Cincinnati Model EA, m.d., hydraulic
No. 10 Brown & Sharpe, m.d.
6x18" Landis, m.d.
6x32" Fitchburg Type A, m.d., latest
8x36" Brown & Sharpe, belt
8x36" Cincinnati Saddle Type, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, model EA, m.d.
10x48" Brown & Sharpe, belt
10x48" Landis Type C Hydraulic, m.d., latest
10x72" Landis, m.d.
12x36" Landis, m.d.
12x36" Modern, belt
12x36" Modern, m.d.
12x36" Cincinnati, belt
12x42" Landis, belt
12x48" Modern, belt
12x48" Cincinnati Self-Contained, 3 m.d.
12x72" No. 18 Brown & Sharpe, belt
12x96" Landis, m.d.
14x18" Cincinnati Self-Contained, 3 m.d.
14x48" Cincinnati Self-Contained, 3 m.d.
14x52" Norton, motorized
16x72" Landis, m.d.
16x216" Landis Type B Hydraulic, m.d., latest
20x120" Landis, m.d., with gap
26x96" Landis, m.d.

UNIVERSAL CYLINDRICAL GRINDERS

14x36" Cincinnati Hydraulic, m.d., latest
16x68" Landis, belt
12x30" Brown & Sharpe, belt
12x36" Cincinnati, belt

DISC GRINDERS

7½ H.P. Standard Elec. Tool Co., new
7½ H.P. United States Elec. Tool Co., new
No. 4 Gardner, m.d.
No. 20 Gardner Comb. Disc Grinder and Roll Sander, m.d.

TOOL & CUTTER GRINDERS

Gleason Cutter, belt
No. 2 Cincinnati Universal, m.d. in base
Cincinnati Monoset, m.d. in base
Gould & Eberhardt Gear Cutter, belt
No. 1 Cincinnati, belt
Style D6A Gallmeyer & Livingston, m.d.
Sellers type 05D Bench Drill, m.d.
No. 3 Gallmeyer & Livingston, m.d. in base
Gisholt Tool, belt

GEAR MACHINERY

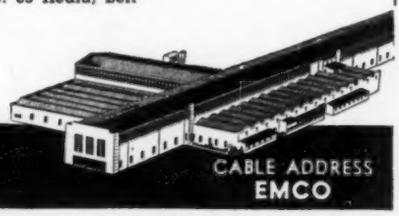
Type A Barber-Colman Gear Hobber, m.d., latest
No. 12 Barber-Colman Double Overarm, m.d., for splines
Type T Barber-Colman Gear Hobber, m.d., latest
No. 34 Brown & Sharpe Gear Hobber, m.d.
No. 44 Brown & Sharpe Gear Hobber, m.d.
No. 18 Fellows Gear Shaver, m.d.
6" Gleason Straight Tooth Bevel Gear Generator, belt
8" Gleason Mfg. Type Straight Bevel, m.d.
11" Gleason Straight Tooth Bevel, m.d.
11" Gleason Straight Tooth Bevel, belt
12" Gleason Straight Tooth Bevel, m.d.
9" Pratt & Whitney Hydraulic Spur, m.d.
10" Pratt & Whitney Hydraulic Gear Grinder for spur and helical, m.d.
48" Cleveland Gear Hobber, m.d.
Gleason Spiral Bevel Gear Rougher, s.p.d.
No. 2HS Lees-Bradner Spur & Helical Gear Grinder, m.d.
No. 3-26" Cincinnati Spur Gear Cutter
No. 3 Heavy Brown & Sharpe Spur, m.d.
No. 4-36" Brown & Sharpe Spur, m.d.
No. 6-60" Brown & Sharpe Spur, m.d.
No. 13LS Fellows Gear Lapper, m.d.
No. 61 Fellows Gear Shaper, belt
No. 64-S Fellows Gear Shaper, m.d.
No. 71-A Fellows H.S. Gear Shaper, m.d.
Cincinnati Gear Burnisher, m.d.
Cross Gear Rounder, belt
Schuchardt & Schutte Gear Tooth Rounder, belt

CENTERLESS GRINDERS

No. 2 Cincinnati, m.d., Filmatic Spindle Bearings, latest
No. 2 Cincinnati, m.d.
Cincinnati Valve Seat Grinder, m.d.

CYLINDER GRINDERS

No. 50 Heald, m.d., hydraulic, brand new
No. 73 Heald Airplane Cylinder, m.d., brand new
No. 55 Heald, m.d.
No. 55 Heald, belt
No. 65 Heald, belt



THE EASTERN MACHINERY COMPANY
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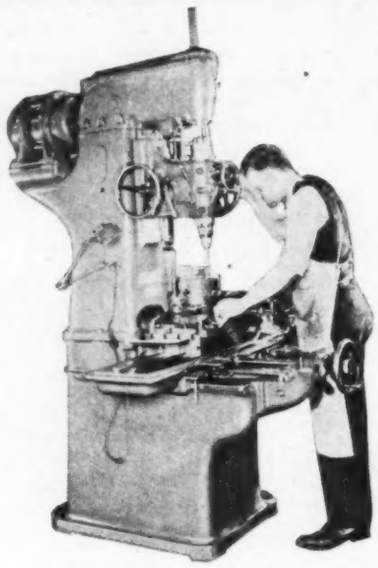
MElrose 1241
CABLE ADDRESS EMCO

LOOK TO THE FUTURE

Round out your production facilities —your machine tool requirements— with Botwinik Brothers' wide variety of quality used and rebuilt machines. Plan carefully for the future! A little thought and foresight now will pay big dividends as your production demands increase. Botwinik's service from the engineering to the shipping department offers you outstanding savings in both time and money. Let the machines listed here become a guide to your requirements.

Write, wire or phone.



★ MILLERS

1—Kearney & Trecker #2K Vert., latest type, tbl. wkg. surf. 56" x 12", long. range 28", vert. 14", cross 12", M.D.

1—Cin. #3 Horizontal Plain Dial Type, latest design, tbl. wkg. surf. 58¾" x 15", long. range 34", cross 12", vert. 20", A.C. elec. equip.

1—B. & S. #1A Univ. Double Overarm Timken Bearing, Motor in base, tbl. wkg. surf. 40¾" x 11¼", long. range 22", cross 8", vert. 18", A.C. elec. equip.

1—B. & S. #2 Univ. Cone Driven, tbl. wkg. surf. 39¼" x 8", long. range 28", vert. 18", cross 10", M.D., with attchmts.

★ BORING MILLS

1—Bullard 24", 36" and 42" New Era Type, with side head, M.D.

1—Colburn 48" Vert. Rapid Trav., height under cross rail 44", 2 heads on cross rail, M.D.

1—Niles 53" Vert., height under cross rail 44½", rapid trav., M.D.

★ LATHES

P. & W. 16" x 36" Model B 8 Speed Gr. Hd., motor in base, pan bed, taper attchmts.

1—P. & W. 20" x 48" Model B Pan Bed, taper attchmt.

3—Leland-Gifford 16" x 8' Ball Bearing Spdle. Cone Type, M.D., engine, actual swing 18½", dist. btw. cens. 50".

4—Leland-Gifford 10" x 10' Ball Bearing Spdle, actual swing 18½", dist. btw. cents. 74".

1—L. & S. 16" x 8' 12-speed sel. Gr. Hd. Eng., M.D., swing over bed 18½", dist. btw. cents. 54".

1—P. & W. #1½B Jig Borer (late type), tbl. wkg. surf. 12" x 24", tbl. trav. long 18", cross 12", hd. trav. on col. 7¼".

1—L. & S. 16" x 6' 12-speed Sel. Gr. Hd. Pan Bed M.D. Eng., swing over bed 18½", dist. btw. cents. 30¾".

1—P. & W. 16" x 6' Model M 8-Speed Quick Change Geared, Gr. Hd. Pan Bed M.D. Gen., taper attchmt., swing over bed 16¾", dist. btw. cents. 34".

1—Bridgeford 36" x 56' 15-Speed Gr. Hd. Eng., M.D., A.C. elec. equip. power rapid trav. to carriage, swing over bed 38", swing over carriage 26", dist. btw. cents. 48', taper attchmt.

1—Reed-Prentice 27" x 21' 12-Speed Gr. Hd. Eng., swings 30", dist. btw. cents. 15' 2".

1—Whitcomb-Blaisdell 29" x 25' Quick Change Gear Double Back Gr., Cone Type, motorized, swing over ways 20", dist. btw. cents. 21'.

★ MISCELLANEOUS

1—Sleeper & Hartley #3 Univ. Coiler Clutch Type, wire range #12 feed from 6" to 50' of wire, coil range ⅜" to 3½" inside diam., weight approx. 3100 lbs.

1—Sleeper & Hartley #2½ Univ. Coiler Clutch Type, wire range #16 feed from 6" to 60' of wire, coil range ¼" to 2¾" inside diam., output of 100' of wire per min., approx. weight 2200 lbs.

3—#3A Standard Rotary Swag. Machine, capac. 2⅛", latest type.

BOTWINIK BROTHERS OF MASS., INC.

3 SHERMAN STREET WORCESTER (1) MASS.

DRILLS

28" Cincinnati Bickford, Sliding Head
32" Cincinnati Bickford, Sliding Head
6' American, Radial
4' Fosdick, Radial

GRINDERS

#2 Reid
#33 Abrasive
Model B Thompson, Hydraulic
#2 Cincinnati Centerless

LATHES

14" x 6' Hendey, Tie Bar
15" x 6' Sidney
16" x 6' Porter-McLeod
16" x 7' Lehman Hydratrol
17" x 6' LeBlonde, Taper Attachment
19" x 8' Sidney
31" x 21' American, Geared Head

MILLERS

#2 S.P. Van Norman, Plain
#2 Cincinnati, Vertical, Dial Type
#3 Cincinnati, Plain
#4 Cincinnati, Universal

TURRETS

#5 Gisholt, Universal
#3B Foster, Universal

DELTA EQUIPMENT CO.
148 N. 3d St. Phila. 6, Pa.

MACHINE TOOLS

24" x 72" American "New Type T" Engine Lathe

6" Pratt & Whitney Vertical Shaper

#2KM Kearney & Trecker Vertical Miller

#2HS Cincinnati Vertical Miller

#3SU Van Norman Universal Miller

#18 Blanchard Grinder, 30" Chuck

3'-11" Carlton Radial Drill

8" x 48" J. & L. Thread Grinder

ALL LATEST TYPE MACHINES

HAZARD BROWNELL
350 Waterman St., Providence 6, R.I.
Dexter 8880

SURPLUS REDUCERS

In original crates. Never Used.

4—Link Belt No. H-1
P. I. V. Reducers
2-1 Ratio CU-DU

4—Link—Belt No. H-2
P. I. V. Reducers
2-1 Ratio CU-DU

LAHEY FOUNDRY & MACHINE CO.
MUSKEGON MICHIGAN

Sciaky 40 KW spot welder
#4 Baush 36 spindle drill, m.d.
48", 52", 60", 66" vertical boring mills
New #3B B & S plain miller
Browning steam locomotive crane 50 ft. boom

JOHNSON MACHINERY COMPANY
222 MARKET ST. NEWARK, N. J.

GRINDER

Sheffield Micro-form Grinder complete with circular grinding attachment. Used 2 to 3 months. Price $6,500.00.

FS-741, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

GRINDERS

#72A5 HEALD PLAIN INTERNAL GRINDER
#72A3 HEALD PLAIN INTERNAL GRINDER
Machines motor driven with motors. Late type.

J. L. LUCAS & SON, INC.
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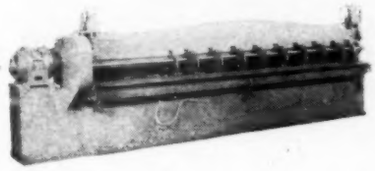

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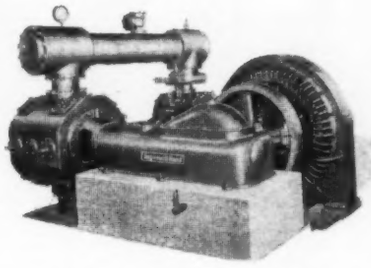

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COMFORTABLE PROTECTION AGAINST ACCIDENTS CAUSED BY BLURRED VISION

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It has adjustable headband and 7¼" sponge to cover even the widest brow — may be easily sterilized for continued use.

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Safety Division

Southbridge, Massachusetts. Offices in Principal Cities

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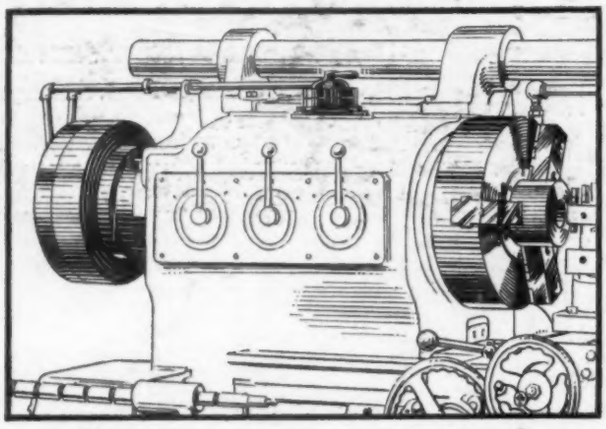
SKINNER POWER *Chucks*

for FAST CHUCKING



Modern production calls for fast accurate machining, *plus* the elimination of as much idle time as possible. That's where Skinner Power Chucks can help you.

On turret and engine lathes and automatic machines where long runs and repetitive operations are performed, the chucking time may be an appreciable part of the total operation time. Skinner Power Chucks are designed to grip fast, hold tight, and release fast — all by means of a single operating lever. This means a minimum of chucking time and a minimum of operator fatigue.

Skinner power chucking equipment includes a complete line of self-centering, non-adjustable and combination adjustable chucks, air cylinders, operating valves, gauges, filters, etc. — all are designed for long life and trouble-free service. Write for Catalog No. *57* which gives complete details and specifications on all Skinner products.

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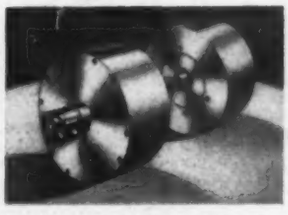

Double acting rotating air cylinder for fast operation of power chucks and special headstock fixtures.

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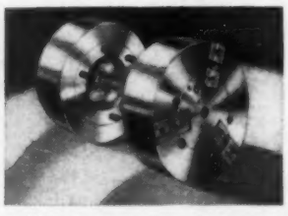


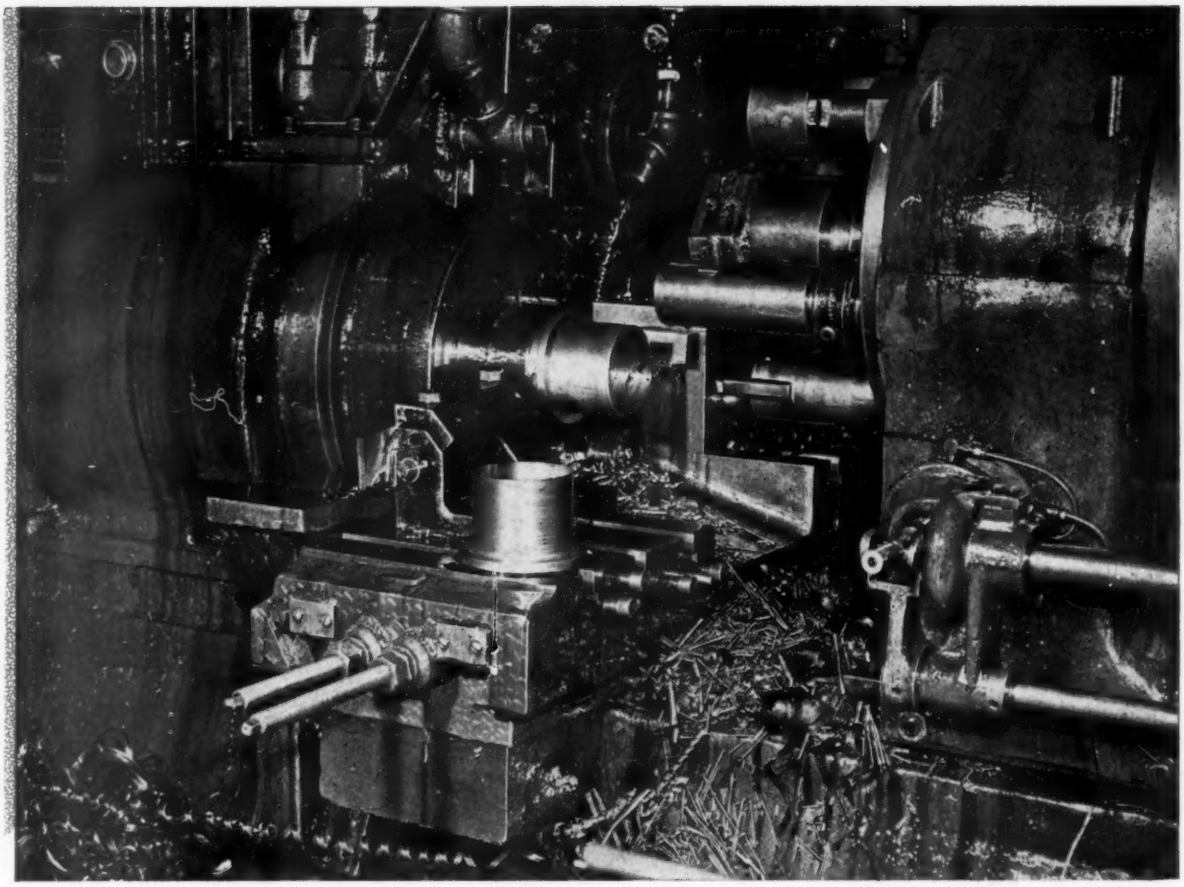
Self-Centering power chuck with three non-adjusting jaws and forged steel body.

THE SKINNER CHUCK COMPANY 343 CHURCH ST., NEW BRITAIN, CONN.

THE CREST OF QUALITY

SKINNER CHUCKS

HAND & POWER OPERATED MACHINE CHUCKS—AIR CHUCK EQUIPMENT—FACE PLATE JAWS—MACHINE VISES



ONE SETUP ON A CLEVELAND AUTOMATIC DELIVERS THIS PART, IN 52100 STEEL

If you want to produce parts like this for profit, remember this simple setup on a Cleveland 5¾″ Model A Automatic . . . STOCK: 4⅞″ bars of 52100 steel . . . TOLERANCES: .003″ overall . . . TOOLS: carbide, in five turret stations and two cross-slide mountings . . . SEQUENCE: 1 . . . Gauge stock; 2 . . . rough turn two diameters OD and centerdrill; 3 . . . rough out ID and flat bottom from turret and finish-form two ODs from rear cross-slide; 4 . . . rebore ID and finish flat bottom, start cutoff from front cross-slide; 5 . . . finish ream, complete cutoff. Part is delivered faster than by any method previously used. Machine automatically proceeds with next piece. A total of 16.9 lbs. of metal is removed. The 5¾″ A is but one of the versatile Cleveland line, with capacities from 9/16″ to 10″ described in a new bulletin, available on request.

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9

precision PRODUCES PRECISION

TIMKEN Tapered Roller BEARING EQUIPPED

IN THIS ULTRA-MODERN GEAR FINISHER

No spindle-operated machine tool can perform more precisely than its spindle bearings. The slightest inaccuracy in these bearings is sure to be reflected in the work.

Not even the least deviation of the cutting tool is permissible in this gear finisher, so the manufacturer, National Broach & Machine Co., Detroit, mounts the cutter spindle in Timken Zero Precision Bearings. Thus precision produces precision; gears finished in this machine consistently meet every test and tolerance.

Timken Tapered Roller Bearings are used at several other positions including the vertical and horizontal drive shafts and work centers.

To be sure of having Timken Bearing precision in your machines, make sure the trade-mark "TIMKEN" is stamped on the cup and cone of every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

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TAPERED ROLLER BEARINGS